CANADA



# REPORT OF THE MISSISSAUGA RAILWAY ACCIDENT INQUIRY

THE HONOURABLE MR. JUSTICE SAMUEL G.M. GRANGE
SUPREME COURT OF ONTARIO
COMMISSIONER

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The Honourable Mr. Justice Samuel G.M. Grange,
Supreme Court of Ontario,
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December 1980

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THE SUPREME COURT OF ONTARIO

THE HONOURABLE MR. JUSTICE GRANGE

OSGOODE HALL
TORONTO, ONTARIO M5H 2N5

The Honourable Jean-Luc Pepin,
Minister,
Transport Canada,
Ottawa, Ontario.

Dear Mr. Minister:

I now submit the Report of the Mississauga Railway Accident Inquiry.

Yours very truly,

S.G.M. Grange
Commissioner.

/ma
Encl.

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# INTRODUCTION

On the 4th of December, 1979, the Privy Council by Order-in-Council set in motion this Inquiry. The Order-in-Council is attached as Appendix 1.

The Report is now done. While it is the first Report, I consider it also to be the final Report. At the same time I appreciate that I have not fulfilled my mandate if the terms of reference are given their broadest interpretation. I have certainly dealt as fully as I am capable with terms 1 and 2 being the causes of the Mississauga derailment and the steps to be taken to reduce the risk of recurrence. I have also tried to answer the problems raised in terms 3, 4 and 5 relating to the law and practice in the handling and carriage of dangerous goods but there is this limitation that my consideration and the Report are substantially restricted to the lessons of Mississauga.

I hope I was justified in so restricting it. The railway industry and its accidents are by statute under the continuous supervision of the Canadian Transport Commission and indeed that Commission has through its officers and agents continued its investigation of other

accidents while this Inquiry was pending. Mississauga was a very special accident requiring very special treatment. That treatment I hope this Inquiry has given it.

There is, however, another and perhaps more important reason why the Inquiry was limited substantially to the events of Mississauga. In dealing with that event and its ramifications the Inquiry occupied in evidence and argument a total of 127 days. There were 687 exhibits, many of which were multiple, and 23,594 pages of transcript. To me it is of vital concern that if this Report is to have any value in preventing or helping to prevent a recurrence of the accident, it be completed quickly. The original terms of the Order-in-Council required the submission of the Report within six months which was June 4th, 1980, a date which passed while we were still receiving evidence and before any of the public submissions had been received. The date was later extended to December 4th, 1980 and that deadline will be met although because of the exigencies of translation and printing (if the Report is deemed worthy of either) it may not be in the hands of the public by that time.

I must also concede there is consideration of Item 6 - investigative and corrective action in response

to an accident - only as it affects the federal power. The term does not require or permit me to consider the evacuation procedures carried out by the provincial and municipal authorities which were so important an element in the Mississauga experience and as I have stated in the body of the Report, I did not consider the validity of the decisions of the Command Team to be relevant except in so far as those decisions reflected the danger facing the populace.

Finally there is virtually no consideration of that part of Item 7 dealing with roadbeds and track and their maintenance. The state of the track was not a problem at Mississauga; it had recently been repaired and renewed and was in excellent shape; our problem was one of equipment or rolling stock, its operation and its inspection.

With these acknowledged deficiencies, my Report on the Mississauga Railway Accident of November 10th, 1979 now follows.

# I. THE DERAILMENT

## 1. THE EVENT

A few minutes before midnight on Saturday, November 10, 1979, Train 54 of CP Rail from London, destined for the Toronto yards at Agincourt, suffered a derailment at Mavis Road in the City of Mississauga. The first derailed car was the thirty-third in the one-hundred-and-six car train and was a tank car loaded with Toluene. It took with it twenty-three other cars into the derailment, twenty-one of which were tank cars and nineteen of which, including the Toluene car, the first in the derailment, were carrying what is classed in the Canadian Transport Commission's Red Book (we will hear much more of both—the Canadian Transport Commission will be referred to hereafter as the CTC) as Dangerous Commodities. Fire spread through most if not all of the derailed cars, and the eight, twelfth and thirteenth cars which were loaded with propane exploded and caused considerable damage to neighbouring property. The seventh car in the derailment which was loaded with Chlorine, a deadly gas, suffered a hole in its shell 2 1/2 feet in diameter and, because of fear of the consequences of the escape of Chlorine, almost a quarter of a million people, mainly from the City of Mississauga, were evacuated from their homes and businesses for periods of up to five days. It is that

derailment, its causes, its consequences and the means of avoiding its repetition that is the subject of this Inquiry.

## 2. THE CAUSE

There is really no problem about the cause of the derailment. The Toluene car suffered a "hot box" in its right-rear journal box. Almost all railway cars have eight wheels upon four axles which are numbered one to four from the "B" end of the car. The cars can go in either direction, but for reference purposes one end is labelled "A" and the other "B"; the "B" end is the end where the hand brake is to be found. The axles and wheels are lettered "L" for left and "R" for right looking from B to A. The hot box therefore was in the R1 position. The axles at their extremities are called journals. These journals bear the weight of the car and are housed in journal boxes. The two forward and two rear axles are connected by side frames of which the journal boxes are a part and the whole assembly in front is called the leading truck and the whole assembly behind is called the trailing truck. Inside the journal boxes are bearings resting upon the constantly revolving journals. Some of these bearings—the modern ones—are roller bearings, but the majority and the ones in the Toluene

car (Car 1) were of the friction or plain bearing type. In the plain bearing arrangement a wedge rests upon a brass (the actual bearing) which rests upon the journal with a lubricator pad (soaked in oil) beneath the journal supplying the lubrication which is so sorely needed between the brass and the journal. If for any reason the lubricator pad ceases to perform its task, the bearing and journal will be in direct contact and the journal will start to overheat. Eventually and inevitably if unattended, the journal will burn off and the tank car will collapse. With Car 1 the rear axle, together of course with its two wheels, separated from its truck and the car over a mile short of the derailment site. The car proceeded on its six wheels to and past Erindale Station Road where apparently the front wheels of the trailing truck, i.e. R2 and L2 derailed. The wheels however did not then detach and the car proceeded on its 6 wheels, 4 on the rails and 2 off, almost to Mavis Road where the remaining wheels hit a switch and the whole car derailed. The other 23 cars then followed it off the track.

## 3. THE CONSEQUENCES

The eventual resting place of the 24 cars is shown on the attached Appendix 2 reduced from Exhibit 14 at the Inquiry. I will deal later with the properties

of the commodities involved and the remedial action taken. It is sufficient now to repeat again that 3 of the cars exploded within one-half hour of the derailment and as a result of these explosions 3 great fire balls were sent into the sky and the larger parts of the bodies of Cars 8, 12 and 13 were sent flying 145 feet east, 440 feet southeast, and 2222 feet (sometimes stated to be 2214 feet) northeast respectively with other parts sent in varying distances in all directions. These explosions are known (not always accurately) as BLEVE's——an acronym for Boiling Liquid Expanding Vapour Explosion——to indicate that the pressure within the tank induced by the boiling liquid has expanded as it vapourized to the point where the tank could no longer resist the pressure. The main property damage was inflicted by the explosion of Car 12 in a south-easterly direction but not as much damage was done as might have been expected and miraculously no casualties were suffered. The reason is simple and most fortunate; notwith-standing that the train had entered one of the most concentrated population centres in the country, at the precise point of the derailment, there was to the immediate south only industrial property, and to the north and northeast, except on the strip of Mavis Road itself, there existed one of the few large areas of undeveloped land remaining in the greater Toronto region.

The main problem, however, was not with the propane explosions however spectacular and potentially dangerous they may have been. What most concerned the authorities was that it was apparent almost from the beginning that some Chlorine was escaping into the air and it became known at least by the early morning of Monday, November 12, that Car 7 in the derailment, the Chlorine car, had a hole between 2 and 3 feet in diameter. No one could make an exact measurement of the amount of Chlorine remaining in the car and no one could give a guarantee that what remained would not be released in either the process of sealing the hole or in the process of removing the Chlorine from the sealed tank. As a result, as I have said, a large portion of Mississauga together with a small part of Oakville to the west and isolated pockets of Etobicoke, a Borough of Metropolitan Toronto to the east, was evacuated on Sunday, November 11, and the area of Mississauga from Burnhamthorpe Road south to Lake Ontario, and from Highway 10 on the east to Erin Mills Parkway and Southdown Road on the west—an area of about 45 square kilometers (17.4 square miles) involving close to 75 thousand people remained evacuated until Friday, November 16. Even then, however, the Chlorine car was not completely empty. The draining of Chlorine and the clean-up of the site continued for some days, once again fortunately without casualty. Nevertheless the property damage and to a much larger extent the evacuation of the population was a major

disruptive force in the history of Mississauga and surrounding areas and demands a full investigation. The results of that investigation follow.

## II. THE WITNESSES

For purposes of fixing the location along the railway line, we will use the mileages of the Galt Subdivision of the London Division of CP Rail. Metrication has not yet come to the railways; distances are measured in percentages of a mile and speed in miles per hour. The Galt Subdivision is measured from Union Station at Toronto (mileage 0.0) to London (mileage 114.6). The mileage at Mavis Road, where the derailment occurred, is 16.56. Other relevant mileages are as follows:

| | |
|---|---|
| Guelph Junction | 39.02 |
| County Road 9 Campbellville | 38.58 |
| Trafalgar Road | 27.57 |
| Winston Churchill Blvd. | 24.65 |
| Derry Road | 23.43 |
| Ontario Street, Streetsville | 21.20 |
| Eglinton Avenue | 19.25 |
| Burnhamthorpe Road | 17.98 |
| Erindale Station Road | 17.35 |
| Wolfedale Road | 16.82 |

All of these locations can be found in the attached Appendix 3 which is a portion of Exhibit 5 on the Inquiry.

At or near all of these points except Winston Churchill Blvd. there were witnesses to the passage of the train. Some of those witnesses saw smoke or flames or sparks emanating from the train; some did not. Winston Churchill Blvd. is included only because it marks in this area the start of what we will see is the curve most advantageous for the viewing either from front or rear of the train of a hot box or any other exceptional feature to the right or south side

of a train proceeding eastward. The witnesses at Guelph Junction were CP Rail employees and their evidence will be detailed when we consider the progress of the train itself.

1. CAMPBELLVILLE

The first non-rail witnesses were Mr. and Mrs. Alfred James Houston of Mississauga, who on November 10 were visiting friends west of Campbellville. At about 11:15 p.m. they were stopped on the south side of County Road 9, mileage 38.58. They noticed smoke coming from the train. Mr. Houston said to his wife that it looked like smoke from a journal box. His wife suggested it might be smoke from braking, but Mr. Houston thought not. It was the only smoke they saw emanating from the train; to Mr. Houston it did not appear to be coming from the part of the wheels where brake smoke would be expected but rather from the journal box; Mrs. Houston could say only that the smoke was coming from the right rear of a car and could not be more precise. While they lived in Mississauga they had previously lived for many years in the Campbellville area; Mrs. Houston had before seen sparks from a train at that point but never smoke. Mr. Houston had before seen neither smoke nor flame nor sparks from a train at that point.

Mr. Houston said the smoking car passed him at about 20 miles per hour but the train had speeded up to about 40 miles per hour by the time the caboose passed.

They proceeded eastward along Highway 401 arriving in Mississauga just as the train blew up. There can be no doubt that the train they saw was the one involved in the derailment.

2. TRAFALGAR ROAD

Mr. Frank Anthony is a farmer who lives in Limehouse, Ontario and undertakes the farming of others' lands on a contract or rental basis. In the late evening of November 10, he was farming rented acreage immediately to the northwest of the Trafalgar Road crossing of the CP line (mileage 27.57). As the train went by he had harvested corn in an adjacent field and was seated on a combine proceeding east at a point about 500 feet north of the track and about 1200 feet west of Trafalgar Road. The seat of the combine is about 10 feet from the ground and the CP tracks are 5 to 7 feet above ground level.

When he first noticed the train the locomotive was slightly ahead of him. As a child he had regularly visited an uncle who was a CNR station agent, one of whose jobs was the inspection of trains, and he had helped his uncle in that task from time to time. In any event he was tired and bored on the night in question and looked

at the train throughout its length. He saw nothing out of the ordinary; no sparks, no flames and no reflection of either. It is to be remembered he was looking from the north side and the hot box that eventually caused the derailment was on the south.

He estimated the speed of the train as about average, in his view between 45 and 50 miles per hour.

3. DERRY ROAD

The next witnesses were Mr. and Mrs. David McGregor, who were eastbound on Derry Road when they stopped for the crossing. (At this point the rail line has turned south and most of the roads it crosses go east and west until south of Burnhamthorpe where the track again turns east, but in railway language the line is deemed always to be running east and west between London and Toronto. That would place the McGregors on the "south" side of the train). They saw a light on the train about 200 feet from the crossing and as the car passed they could see that the light was indeed fire and coming from the wheels. Mr. McGregor said the flame was a maximum of 4 feet in diameter and extended out from the undercarriage about a foot and trailed as well. He was afraid it might cause a brush fire as it went down the

track and he could see it clearly as the train proceeded on its way. Mrs. McGregor also said the fire extended out about a foot, but estimated its diameter at 2 feet.

Mr. McGregor thought the train was going about 50 miles per hour. Mrs. McGregor estimated it at 50 to 60 miles per hour and said it was "going very rapidly past".

4. STREETSVILLE

Between Derry Road and Eglinton Avenue there were two witnesses who saw the train from outside their houses which were on the west (or south in railway terms) side of the tracks.

The first was Miss Nancy Bota, who resides at 100 Rutledge Road, which is just south of Ontario Street at mileage 21.20. On November 10 she was outside her house feeding her dogs when she saw the train go by from about 35 to 40 feet away. She saw neither the front nor the end of the train and she was not particularly watchful of it. She saw no smoke or flame; the only thing she did see was some sparks coming from one wheel at the rail and that was not an unusual sight to her. She said the train was going faster than usual and "pretty quickly". When pressed she estimated the speed at between 45 and 50 miles per hour.

The second witness in this area was Miss Cynthia Carter, who resides at 1651 Barbertown Road, which is about 700 feet (215.7 meters) north of Eglinton and about 140 feet (41.5 meters) west (in railway language south) of the tracks. At the relevant time she was standing on a walkway 12 feet east and 5 feet south of her house. She saw the train go by and out of habit counted the cars reaching a total of 116. She said she counted them by observing the light between the cars, that she could see each car from top to bottom and that she observed neither flame nor sparks nor smoke emanating from any car. The great difficulty with her evidence is that she stated that she looked straight and not at an angle at the tracks, but Det. Sgt. Bertram, a police officer retained by the Commission, testified that from the position in which she stated she was standing and looking in the direction in which she stated she was looking, one could see only the top half of the cars; if that be so she could see no part of the running gear at all.

## 5. EGLINTON AVENUE

Mr. Henry Siu was driving home from work east on Eglinton Avenue and saw the barriers come down as he approached the crossing. While stopped he caught a flickering to his left and turned his head to see fire coming from one of the wheels of an approaching train. It

extended over about one-half the wheel and trailed 2 or 3 feet. The flame was reflected on the bushes as the train went by. He estimated the speed of the train at about 55 miles per hour.

6. BURNHAMTHORPE ROAD

Mr. and Mrs. Timothy Truckle were in the second car facing the crossing coming from the east; in railway terms they were on the north side of the tracks. They both saw sparks and flames coming from the bottom area of a car. Mrs. Truckle said it seemed to be coming from a wheel but Mr. Truckle identified the source as the rear axle. He also said the flame, including the sparks, was about 5 feet in diameter. He had no sensation of excessive speed.

Mrs. Catherine Hutchinson was in the car behind. She said she saw the light first more than half way up to McConnell Road (mileage 18.65). It appeared like a bush fire and then as friction or sparks, not flames, about 3 feet around and shooting out from the train. She followed it as it crossed Burnhamthorpe and saw the train buckle and something fly out of it. She described the object as 1 1/2 feet big and it landed, she thought, just beside the train.

I pause now to relate the adventures of Mr. and Mrs. John Riddel who lived at 1437 Freeport Drive, which backs on to the railway track just south of (or as the railways would have it, just east of) Burnhamthorpe Road. Mr. Riddel was asleep at 11:45 and Mrs. Riddel was in bed but awake and heard the train go by. She heard first a crack and then an explosion. She went to the window and saw the fire at Mavis Road. She also saw in her garden a red glow and by the light of the explosion could see that it was a set of red-hot wheels. She immediately woke her husband who went outside to find a neighbour already hosing down the wheels. He (the husband) went to the track and to the Burnhamthorpe crossing and 25 yards beyond. He found marks on the south side of both rails for eastbound traffic. He also saw the gouge in the ballast where the wheels had left the rails. He found a cotton pad and two pieces of foam rubber or plastic saturated in oil on the north rail of the south track about 20 or 30 feet east of the crossing. He also found a chunk of metal about 3 inches by 4 inches and one-quarter inch thick on the south side of the south rail. Mrs. Riddel said that the train when she heard it was definitely not going too fast. She could tell its speed by the noise.

Mr. Alberto Galvan, who lives just two doors from the Riddels at 3681 Codrington Court, was in his living room when he heard the engine go by. He went to

the bedroom of one of his young sons briefly and then to that of the other son from whose window one can see the train passing by. In that room he pulled the curtains and watched perhaps 30 cars. He saw no flame or sparks or unusual light. He also did not see the wheels in the Riddels' back-yard although the yard was visible from the boy's window; nor did he hear any unusual noises from the train or from the Riddels' yard. He estimated the speed of the train at between 40 and 45 miles per hour.

7. ERINDALE STATION ROAD

Dr. John Carey was proceeding west on Burnhamthorpe intending to go south on Erindale Station Road. Just as he was making his turn he saw a light in the train as it was making the crossing at Burnhamthorpe. When he proceeded down Erindale Station Road and the train crossed his path, he saw a white light on the back of a tank car which lit up about two-thirds of the car together with white sparks in a fan shape, 2 or 3 feet off the ground. He also saw what he took to be the brakeline uncoupled at the rear of the car.

Mr. Winston Chandler was walking his dog on the other side of the Erindale Station Road crossing.

He saw a shower of sparks about 4 or 5 feet high spraying out coming from under one of the tank cars near its junction with another car. He said the train was moving as fast as any train he had seen at that crossing.

We also heard evidence from Mr. Gavin Correa, who resides at 3592 Ellengale Road, close to Erindale Station Road. His living room faces the track about 25 to 30 yards away. A passing train can be seen through a large patio door and he was facing the patio. Between the door and the track is a slatted wooden fence, the solid part of which obscured the lower portion of a passing train. On the night in question he watched about one-third of the train, glancing, as he said, out of the patio door every now and then (he was accompanied in the room and engaged in conversation with three other persons) and he saw nothing unusual, no smoke, no flames, no sparks.

## 8. WOLFEDALE ROAD

At the Wolfedale crossing, Mr. Paul John Richard Harwood and his passengers, who included his wife, Mr. Clarence Hyde and Miss Cheryl Ross, were travelling south and stopped behind other cars for the crossing. Mr. Harwood saw a tanker going by sparking with the sparks rising to about half-way up

the car. He noted that the tanker seemed to be listing over about 15 degrees. Miss Ross at first thought the sparks rose about one-third of the way up the car; then she said, they rose over the top. Mr. Hyde saw two sets of sparks, the first spraying out from one car and sending a shower to the top of the car, and then after a gap, some more bright white sparks. He said he had not seen trains go as quickly before. Miss Ross said the train was going quickly but not faster than she had seen other trains go.

On the other side of the Wolfedale crossing Mr. James Allan Duke was driving the only car stopped for the train. He too saw two sets of sparks, the first being very unimpressive but the later sparks about 3 or 4 cars away from the first were much heavier fanning out in all directions and illuminating the lower section of the tanker. The train seemed to be going faster than other trains.

Police Constable Elliot (Chuck) McConnell lives on Eagle Mount Crescent and his property backs on to the track near Wolfedale. He didn't see the train before the derailment but he heard it. The engines sounded all right but as the train went by it was screeching and banging. He had no particular impression that it was going fast. After the

derailment he went out to the track where he found a reddish-white piece of hot metal which turned out to be a journal stub. Indeed it is believed to be the stub of the Car 1 R1 journal and much more will be said of it later on.

9. MAVIS ROAD

At Mavis Road itself, driving south and stopped at the crossing, were Mr. and Mrs. Ronald Walter Dabor. They are our only witnesses to the derailment. As the train passed their first concern was its speed. Mr. Dabor estimated that speed at 70 miles per hour and noted that the cars seemed to be leaning towards him. Mrs. Dabor, an inveterate counter of cars, found she could not follow her avocation because the train was going too fast. She also found the train to be swaying. As she looked to the right she saw what she first thought to be flares, but then realized were sparks. She then saw that there was a wheel off the track creating bright yellow and red sparks.

One car and then another seemed to lurch at them and Mr. Dabor started to back his car up as fast as he could. As he did so, his wife saw the train cars start to uncouple in the air. Although there was no one behind

them Mr. Dabor, not unnaturally, lost control of his car and it became immobilized in a ditch. By this time the fire and the explosions had started. They evacuated their car and escaped to the north being at one time thrown to the pavement by an explosion.

All of the others at the scene who gave evidence were witnesses only to the explosions and to the conflagration subsequent to the derailment. The recitation of the evidence of the witnesses listed above will be very relevant when we come as we do now to the consideration of the train itself, its inspection, its manner of operation and whether the hot box should have been seen before the derailment.

## III. THE TRAIN TO GUELPH JUNCTION

### 1. THE RULES

Before we consider the operation and inspection of the train, we must know the rules.

The fundamental rules are found in the Uniform Code of Operating Rules promulgated by the Board of Transport Commissioners (now the Canadian Transport Commission) and the Code is supplemented by rules published by the railways themselves.

The relevant inspection sections of the Uniform Code are as follows:

> 90A. Unless otherwise directed by special instructions, on freight, mixed and work trains in motion between stations, conductors and enginemen will see that trainmen are at the front and rear of trains in position to observe the safe operation of trains and, when practicable, exchange signals when approaching and passing stations. Approaching junctions, railway crossings at grade, drawbridges, points where trains may be required to stop, where trains are to be met or passed, and at a safe distance before descending heavy grades or at any point where failure of the brakes may be attended with hazard, a trainman must be within convenient access of the emergency valve.
>
> 111. When other duties will permit, employees in the vicinity of passing trains must observe the condition of equipment in such trains; trainman at rear of moving trains will be in position, on rear platform where provided, and trainmen of standing trains in best possible position on the ground from which a view of

both sides of passing trains can be obtained. If a dangerous condition is apparent every effort must be made to stop the train.

Train and engine crews of moving trains must, when practicable, be on the lookout for signals given by employees calling attention to conditions on their train.

Trainmen at rear of moving trains must frequently look back at the track to see if there is evidence of dragging equipment.

Conductors and trainmen must know that cars in their trains are in good order before starting and inspect them whenever they have an opportunity to do so. All cars taken in their trains en route must be examined with extra care.

When practicable, employees of a moving train must make frequent inspection of their train to ensure it is in order, and when a freight train stops a trainman will be in position to inspect the train as it pulls by.

When starting freight trains speed must be regulated to permit trainmen to entrain.

The extension of these rules by CP Rail is found in s. 2, Rules 4.1 and 9.1 of the General Operating Instructions as follows:

4.1 When practicable, crews equipped with radio at the front and rear of trains will communicate with each other at the following times and places:

a) Before passing stations, stating the name of the station in the communication.

b) Between one and three miles from -
yard limits and station limits on trains affected by Rules 93 and 93A.
-points where protection of impassable or slow track has been provided by train order.
-points at which the train is required to wait, meet, pass another train, clear a superior train, move through a siding or when required to stop clear of or move through a crossover.

c) Transmission of results of all running inspections of the train and track to the rear.

9.1 In addition to the strict compliance with Rules 90A and 111, a member of the crew must inspect their train when in motion from both sides of the diesel unit and at the rear of the train from both sides of the caboose, for any evidence of a hot box or defective equipment or shifted load.

(Sub-clause c) of Rule 4.1 of CP Rail's General Operating Instructions does not fit grammatically but I presume it is intended that after the inspections have been made as required in sub-clauses a) and b) there will be transmission of the results by radio between the head and the tail end of the train.)

There is no binding statutory rule for mechanical inspection of a train (except a limited one promulgated by the CTC relating to inspections at places of origin of a dangerous commodity car which I will refer to later) but by the rules of the Association of American Railroads of which CP Rail (as well as Canadian National) is a member, the railways are responsible for the cars of others after they have accepted them. It is the practice of CP Rail to have a mechanical inspection of every train as soon as it is marshalled and to inspect mechanically all cars received at interchanges and all added cars along the route where practical. The practicality is governed by the fact that mechanical inspections are performed by carmen and cannot and are not normally performed by the crew. For our purposes, a

mechanical inspection involves, where friction bearings are in place, the lifting of the lid of the journal box and the checking of the level of oil as well as inspecting for any defects in the parts that might be apparent from such a view.

The running inspections as required under the rules, supra, are to some extent left to the crew's discretion. The general practice seems to be that at every station the engineman is expected to call the mileboard—which is located one mile short of the station or of the switch leading to the station siding—and then the conductor and the rear end trainman (if there is one) make an inspection of the train forward on both sides, and backwards for signs of anything dragging. The conductor then radios from the caboose radio his findings. This is often in the form "highball" which indicates that all is well and is acknowledged by the head end.

The other regular occasions for inspection are on curves where one side of the train can be seen from either the head or tail end. As part of their training, crews are taught which curves are valuable for this purpose. The conductor again reports to the head end his findings on the curve, again often in the form of "highball" and the

engineman acknowledges. Both the head and tail end are expected to look up or down the appropriate side. For a right-hand curve and view that responsibility might fall to the engineman who sits on the right, but if he is otherwise occupied, the head end trainman will cross over and look out and back along the right-hand side.

The crew of a train in Canada consisted until recently of four men, an engineman and a head end trainman or brakeman in the engine and a conductor (in charge of the train) and a tail end trainman or brakeman in the caboose or van as the caboose is sometimes called. Effective July of 1979 and pursuant to an arbitration award of the Honourable Emmett Hall, crews could be reduced to three, eliminating the tail end brakeman. This alternative, however, is confined to trains of 120 cars or less and there are built-in grandfather clauses so the change will come about only slowly and through attrition.

2. THE DOCUMENTS

The running of a modern railway requires a great deal of documentation but for our purposes the important documents are first the "consist" which lists the cars in order from the caboose, their destination and their contents. If those contents are classified by the CTC as "dangerous commodities" the consist so specifies. These consists are now computerized and there is or should be a new one prepared or the old one amended each time cars are

set off or lifted. Secondly, there is required for each dangerous commodity car by CTC order an Emergency Response Form which is prepared by the shipper specifying the nature of the commodity and the danger and the appropriate response in case of accident or fire. It also contains an emergency telephone number to call. The document is a Canadian invention and unlike most other rules has no United States counterpart or application. In any event, the consist is provided to and kept by both conductor and engineman and the Emergency Response Forms, where required, are provided for and kept by the conductor.

Two other documents with which we may be concerned are the train orders and the placards. The former are last-minute orders transmitted to the conductor and engineman en route. They are taken by the operator at the station and handed to the conductor and engineman if it is a scheduled stop, or hooped onto the train to them if no stop is scheduled. They include such matters as changes in meeting times with other trains, special slow orders, etc.

The placards (of which there will be more anon) are cards required again by CTC order to be placed on all dangerous commodity cars. The forms are set forth in the Red Book regulations. The reverse side of these cards still indicates danger but states that the tank car is empty; when that condition exists the card is turned over and reinserted.

Perhaps the most important document by which a freight train is run, however, is the timetable. It contains the times at which the particular train is scheduled to reach a particular station but that in itself is not important because freight trains rarely run to schedule. What is important is that the timetable includes many special orders respecting particular trains and particular areas. It is also almost the only indication to the crew of the maximum speed at any location for any train. As we will see, generally speaking, the railways govern the speed of their own trains.

3. THE LONDON DIVISION

The Galt Subdivision to which I have made reference is part of the London Division. That portion of the division between London and Windsor is known as the Windsor Subdivision. Train 54 which was derailed, originated in London as I have said, but its progenitor was Train 84 out of Windsor. At London it merely changes its crew and its number and proceeds on its way. One of the reasons for the change of crew is simply that most of the trainmen, although resident in London, regularly work either the Windsor or Galt Subdivisions, but not both.

To say that Train 84 becomes Train 54 at London is not to say that the train that leaves London is

the same as the train that left Windsor. That train regularly stops at Chatham and picks up cars of the Chesapeake and Ohio Railway coming from Sarnia. And so it did on November 10, 1979. Indeed, all the cars that derailed were originally from Sarnia and were part of Local 4 of the Chesapeake and Ohio which were transferred to CP Rail at Chatham. To find then the origin of Train 54, we must follow CP Train 84 from Windsor to Chatham, Local 4 of the Chesapeake and Ohio from Sarnia to Chatham and the combined train CP 84 from Chatham to London.

4. TRAIN 84, WINDSOR TO CHATHAM

The first part of that story was, indeed, uneventful. The crew of Train 84 out of Windsor consisted of Conductor Gordon Bach, engineman (or engineer—the former term seems to be preferred by the railway, the latter by the men) Tim Ready and trainmen Charles Cook and William Mahoney. They all live in London and all arrived at Windsor the night before in preparation for taking on the train scheduled to leave Windsor (actually Walkerville) at 1245 on the 24-hour clock. Before they took over, the train had been marshalled by the yardmen and inspected by a carman. We need not be concerned about the marshalling or the inspection because no dangerous commodity cars were included, the only placarded car being empty. The train proceeded on its way, arriving in Chatham at approximately 1500 hours, proceeding to the CP yard which includes interchange tracks where it awaited, pursuant to instructions, the arrival of the Chesapeake and

Ohio Local 4 from Sarnia. As we will see, the latter train pulled into the yard at about 1600 hours but as the cars were being transferred from one rail line to another there was an additional wait for a mechanical inspection.

## 5. THE INSPECTION OF LOCAL 4 AT SARNIA

The Chesapeake & Ohio Railway, a part of the Chessie System in the United States, has track in Ontario from Sarnia through Chatham to Blenheim and from Windsor through Blenheim, St. Thomas, London and Welland to Niagara Falls and Buffalo. The Sarnia, Windsor and Buffalo terminals are linked to trackage in the United States. The head office for Canada is at St. Thomas.

Sarnia is, of course, a major chemical-producing centre and many cars carrying dangerous commodities originate there, some for transportation by CN and some for transportation by C&O. Those destined for CP Rail are carried by the C&O to Chatham and transferred there.

There is no fixed rule, but most of these latter dangerous commodity cars leave Sarnia on Local 4 of the C&O scheduled to depart at 0200 hours, 6 days per week, but as with CP Rail the departure time is very elastic and

on November 10th it actually left at 0710, composed of 69 (or 70 - the evidence is conflicting) cars of which 63 cars were bound for the CPR at Chatham, 4 for the CIL plant at Courtwright and 2 for the CNR at Chatham.

The train, as it was being made up in Sarnia, was inspected by the only carman on duty, Robert Nethercott, who testified to the nature of his inspection. It includes a brake test of all cars (the No. 1 brake test) an inspection of safety devices of the tanks to ensure they are not leaking, of the air hoses to see that they are coupled and of the placards to see that they are in place. It seems that there were only 7 plain bearing cars on the train and for the inspection of these he would lift the lid, check the oil, the brass and the lugs on the brass. He would also make sure that the wedge, brass and lubricator pad were all in position and that the oil was at the required one-half inch level and was not watered. He stated he could not tell whether the right size of lubricator pad was installed. I mention this only because it is alleged that the C&O in an earlier refit of the journal boxes of Car 1 installed oversized lubricator pads and I will deal with that problem when I come to consider the car itself.

For roller bearings he needed only a visual inspection to ensure that no grease was leaking and that the adapter (if any) was in place.

No cars were rejected in the course of that inspection although many minor repairs such as the addition of oil to plain bearings may have been performed. On his "daily inspection report" (which seems to be a weekly report for many train inspections) he made no entry under "Remarks" to indicate any special concern. That report incidentally has a column entitled "Time Air Test Completed with Yard Testing Device" under which each inspector has inserted only his name and the date and has another column entitled "Time Test" and subtitles for the time the test started and the time it was completed. For each of 19 inspections recorded in the one report filed with us, the elapsed time was put at twenty minutes regardless of the length or nature of the train or the time of day or night. There is no evidence that Mr. Nethercott did not do his work properly, but the record is of little comfort to us and I suspect little or no use to the railway.

6. LOCAL 4 FROM SARNIA TO CHATHAM

The train proceeded on its way to Chatham conducted by James Reynolds with Mr. Roberts, his engineer, and Messrs. Mooser and Babcock as rear and head brakeman respectively (the words "brakeman" and "trainman" are synonymous, the former being preferred by C&O, the latter sometimes by CP Rail). The train arrived at the CIL plant at Courtwright at 0810, set off the 4 cars and lifted 6 and continued on its way to Chatham, arriving at the C&O yard after passing by the CPR yard at 1340 hours.

At the Chatham C&O yard 2 of the lifted cars from CIL were set off and the train, now consisting of the 2 CN cars and the 67 CP cars, was taken to the CP yard a few hundred yards to the north and the 67 cars placed partly in interchange track 2 and partly in interchange track 3 at about 1555 hours. The C&O engine with the 2 CN cars then left the CP yard for return to the C&O yard at 1600 hours.

## 7. THE INSPECTION AT CHATHAM

The Chatham carmen are Robert Males and Austin Jones and usually they do the inspection as a team, but Jones has Monday off and Males Saturday, each without a replacement. Consequently on this Saturday, November 10th, only Jones was available. As it happens he saw the train go by as it was proceeding south to the C&O yard and saw it again (slightly reconstituted) on the opposite side as it pulled into the CPR yard. In each case he gave it a "pull-by" inspection which involves a visual inspection of the undercarriage of the train on the move, much like those inspections contemplated in Uniform Rule 111.

As soon as the C&O cars were in place on tracks 2 and 3 he commenced the inspection. Mr. Jones testified that his inspection involved lifting the lids of the journal boxes of plain bearing cars, seeing that wedges, brasses and lubricator pads are in place, and that there is enough oil. He will add oil if

there is only one-half inch preferring to see a level of three-quarters of an inch as opposed to Mr. Nethercott who is quite content with a level of one-half inch. In this inspection he remembers using some oil, possibly 1 gallon. He also remembers finding water in 2 boxes. The rest of the inspection involves seeing that the adapters of roller bearings are in place and there is no excess grease showing, checking the couplers, safety equipment, walkways, handrails, ladders, checking the undercarriage for cracks, checking the handbrakes to see that the chain is in place, checking the brake shoes, the doors of the box cars to ensure they are closed, the placards for placement and the stencils on the cars to ensure that the time for repacking has not passed. It is a formidable task and it appears to have been completed for all 67 cars in 1 hour to 1 hour and a half because the crew of Train 84 had some more switching to do and departed at about 1800 hours. I am not, however, prepared to say that Mr. Jones skimped on the inspection. While it would be quite impossible for me and most others to accomplish the task in a little more than a minute for both sides of each of the 67 cars, it must be remembered that Mr. Jones has been a carman or carman's helper since 1953 and inevitably has acquired much skill and speed in the performance of his duties. It is also to be remembered that the examination of plain bearing journals is the task requiring the most time and of plain bearing cars inspected by him there were only 7.

Mr. Jones also seemed to have difficulty keeping accurate records for he filled in his time for the day on his time card before the inspection had started. I do not suggest any dishonesty, but such conduct gives us no help in determining how long he was engaged and deprives his employers of one opportunity to supervise his work.

After Jones had completed his inspection he announced the fact by radio to the crew. Upon that advice the crew of Train 84 proceeded to couple the C&O cars to the train. They dropped some cars of their original train behind but after coupling had 102 cars including 5 cars to be set off at Woodstock. The cars were numbered from the caboose, the 64th being the Chlorine car and the 70th the Toluene car.

After the coupling the crew were required to perform a brake test. There are 2 types of brake test being called (by CP) the No. 1 and the No. 2. The former is a test of all the brakes in a train and involves the engineman setting the brake, i.e. charging all cars with air. Thereupon the trainmen walk the train, one from each end inspecting the brakes and the release of the brakes. After this is done, the van or caboose is checked by the conductor and then the test is complete. This test (No. 1) is performed at the terminal after a train is made up. When

cars are lifted, however, only the No. 2 test is required. This involves the same procedure but only for the lifted cars and for the van after the lift. At Chatham there was a No. 2 test only but, of course, it involved a considerable lift and a considerable test.

## 8. TRAIN 84 CHATHAM TO LONDON

After the coupling and the brake test Train 84 proceeded out of Chatham at about 1800 hours bound for London. Again there was nothing remarkable on the trip. On arrival at London the train is normally subject to a pull-by inspection by 2 carmen on either side as it pulls into the station. The 2 carmen on duty in London that night were Mario Piccolo and Kenneth Hopper. Hopper was on the south side as the train pulled in and performed his share of the task. As it happened Piccolo was absent on duty and returned only after the train had stopped, necessitating a walking inspection. Neither found any defects or exceptions. Neither the pull-by nor the walking inspection involves lifting the lids of plain bearing journals.

When Train 84 came to a stop at London, the Windsor Subdivision crew came off duty and were replaced by the Galt Subdivision crew, a reduced crew of 3, a rarity made necessary by the unavailability of regular crews.

This crew consisted of William Edward Nichol, conductor, Keith Pruss, engineer, and Larry Krupa, head end trainman. The latter is also the son-in-law of engineer Pruss. It was their task to pick up 4 cars all of which were placed at the tail end bringing the total to 106, but the No. 2 brake test necessitated thereby was performed by Hopper with, of course, the assistance of Pruss in setting the brakes.

## 9. TRAIN 54 FROM LONDON TO GUELPH JUNCTION

The train, besides getting a new crew, now obtained a new number, namely 54, and headed east for Woodstock where it had been ordered to set off the 5 cars destined for that city and placed at the head of the train at Chatham in anticipation and lift 5 more cars for delivery to the Agincourt yards at Toronto. On the way to Toronto it had the first of 3 "meets", that is passing of another train travelling west on the same track, that it would encounter before derailment. This one was at Nissouri at mileage 104 on the Galt Subdivision and involved a train called Extra 5530 West out of Agincourt. (Apparently all trains not mentioned in the timetable——and there are many——are labelled "extra"). This train, manned by Clarence Parsons as conductor, Robert Billingsley as engineer, John Haggith as head end trainman, and Gary Dagelman as rear end trainman, arrived at Nissouri

after Train 54 had arrived, pulled into the siding and passed the stopped train. In doing so, Parsons and Dagelman and Haggith inspected the north side of Train 54 and found nothing unusual. They all saw Krupa on the ground at the switch which he had to work to let Extra 5530 into the siding and to permit Train 54 to proceed after the extra had cleared the switch. For their part the crew of Train 54 inspected both sides of the Extra. Pruss said he put on his headlights and "ditchlights which as I said are very strong" for the purpose. As it happened the model of locomotive he was driving was not equipped with ditchlights. I have no doubt that his statement was honestly made based upon his general custom, but it does not lend credibility to any of his statements of precise facts on the night in question.

At Woodstock - Jellicoe, mileage 88, the train stopped for the lift/set off. As it happens a CPR employee, Robert Deadman, observed the train as it pulled in from the north side and saw no exceptions. Train orders were delivered to the engineer and conductor by the operator who in so doing inspected the south side of the train and found no exceptions. I should mention here that there were train orders at Galt also,another station on the south side at mileage 57.2. Again the operator who delivered the orders inspected the south side of the train and noted no exceptions.

It probably has nothing to do with the subsequent derailment, but the No. 2 brake test made necessary by the lift at Woodstock was not performed. Nichol was caught outside the train when it started to move. There are special rules relating to 3 men crews which rules are set forth in the timetable of the Region at p.69 and include a prohibition against putting the train in motion without a clear direction to the engineer from the conductor. Obviously this rule was breached as well.

Nichol managed to get back on the van and the train proceeded on its way to Guelph Junction. As this was the train in its final form, I should give some relevant statistics. They are -

Length - 6,627 feet

Weight - 9,050 tons

Distance head end to car 33 (Car 1 in derailment) - 2,163 feet

Distance tail end to car 33 - 4,464 feet

The night was cool and dark and clear.

On the way to Guelph Junction the train had two more meets, one at Puslinch, mileage 45, and one at Guelph Junction itself, mileage 39.2. The meet at Puslinch

was with Extra 5748 West out of Agincourt which was in the siding when Train 54 went by. The crew of that extra inspected Train 54 with the head end trainman dismounting and crossing to the south side with a lamp for better viewing. None found any exceptions to the train.

At Guelph Junction the meet was with Extra 5015 West. Guelph Junction is, for trains travelling westerly, the end of the double track, the single track to the west being a continuation of the northern or westbound track. At the juncture, mileage 39.95, is a spring switch enabling trains travelling east to move across to the south track and Extra 5015 stopped with the head end just short of that switch to await 54's arrival. As Train 54 pulled by, it was inspected on the north side by the rear end trainman and the engineman of 5015, and on the south side by the head end trainman, Nicholas Dionne. No one noticed anything unusual although Dionne saw smoke from the brake shoes throughout the whole train. This was not unusual as the train is required to slow to 15 miles per hour for the spring switch and smoke often lingers on after the brakes are released.

There were train orders at Guelph Junction for both passing trains. The operator hooped the orders

to Train 54 from the north side and in so doing inspected that side and noted no exceptions.

Train 54 pulled through Guelph Junction at about 15 miles per hour and headed eastward to disaster.

## IV. THE TRAIN FROM GUELPH JUNCTION TO MAVIS ROAD

The train proceeded from Guelph Junction to Mavis Road, a distance of 22 1/2 miles before the 24 cars derailed. I have already set forth what was seen (or not seen) by the witnesses outside the train over that distance. It is very easy to state what was seen by the crew; they saw nothing, neither Nichol from 73 cars back nor Pruss and Krupa from 32 cars and 3 engines forward. If this were a civil action dealing with the recovery of damages consequent upon the derailment, I doubtless would have to determine whether they should have seen something in the course of that run and taken the appropriate measures to prevent the derailment. I am most anxious not to make any unnecessary findings of fact but I am required by Term 1 of the Order-in-Council to determine not only the causes but the contributing factors and by Term 3 to determine the "level and adequacy...of the practices and procedures governing railway safety with respect to this accident...". The failure to detect the hot box was a failure of the running inspection system. I see no way of avoiding the determination of whether the failure was attributable all or partly to the defects of the system itself or to the default of the persons who employed it. To this end I must consider not only the rules for inspection and the evidence of inspections made but also the opportunities for inspections and the other duties that might have

inhibited taking advantage of those inspections. I think I must also consider the probable state of the hot box at the time the opportunity to see it presented itself, i.e. whether it would be in a state of development of fire that would render it readily visible to the viewer.

1. THE METHOD OF RUNNING INSPECTIONS

As I have pointed out earlier, the crew is required by Rule 111 of the Uniform Code of Operating Rules and Rule 9.1 of CP Rail's General Operating Instructions to make inspection of the train in motion. The latter rule requires inspection "from both sides of the diesel unit and at the rear of the train from both sides of the caboose for any evidence of a hot box...".

As I need hardly point out the best opportunity for observation of the running gear of the train is on a curve and all the railway witnesses described how in their training they came to know the best curves and inspected the train on them. Under CP Rule 4.1(c) the crew are required to transmit, presumably to each other, the results of all running inspections and under Rule 4.1(a) to communicate with each other before passing each station,all "when practicable". The London Division appears to have added to this rule by requiring an

inspection,presumably also when practicable,at the mileboard before each station.

2. COMMUNICATION OF INSPECTIONS

There is no fixed method of communication but it appears customary for the engineer to call the mileboard, for the conductor to acknowledge and then after he has made his inspection to report the results to the engineer who acknowledges. A satisfactory, i.e. no defect, result is often signified by the word "highball". On curves it is usually the conductor who initiates the highball and the engineer who acknowledges.

3. DUTIES AT THE HEAD END

While primarily the engineer is responsible for observing back the right-hand side, when he is engaged in other duties he may direct the head end trainman to come over to that side and look back. The inspection on the left-hand side is, of course, performed by the head end trainman. These inspections are made by looking back out the right or left window. On the night in question the lead locomotive was a GO unit, equipped with rear-view mirrors. The GO units were sometimes rented on weekends but none of the crew had

much experience with them. Pruss and Krupa specifically stated that they at no time made use of the rear-view mirrors or really appreciated their existence. In this they were supported by their superiors, particularly Mr. George Bathgate, the road foreman, who maintained that rear-view mirrors were no part of CP Rail's training or operation and he would forbid their use if he thought any engineer or trainman was tempted.

## 4. DUTIES AT THE TAIL END

The van or caboose is equipped with a cupola or observation dome on the top having seats on either side and a platform at the rear. At the mileboard inspection the conductor (and/or the rear end trainman, if any) generally go back to the rear platform and down the steps to lean out and regard the train from either side and to the rear. On curve inspections there seems to be no set formula and the inspections can be made either from the platform or the appropriate side of the cupola.

## 5. THE CURVES

It is clear from the evidence and from the examination of the route of the track that there is no

good curve for visibility after Guelph Junction until one gets to Winston Churchill Blvd. which is the start of a long, fairly pronounced curve to the right, leading into Streetsville. At the south end of Streetsville there is a short curve to the left (sometimes known as the Reid's Mill Curve) and the track proceeds across the Credit River; it then turns to the right again and proceeds south to cross Eglinton, McConnell (Hydro) Road and Burnhamthorpe. After Burnhamthorpe it turns gently to the left and is going almost straight and more or less easterly when it crosses Mavis Road.

## 6. THE EVIDENCE OF THE CREW

The engineer, Keith Pruss, testified that pursuant to orders in the timetable he reduced the speed at Guelph Junction to 15 miles per hour and picked up speed as the van cleared the spring switch. He said there were poor inspection curves allowing only glances at part of the train from there through Milton. He said he called the mileboard at Milton and got a highball back from the conductor. ( At another point in his evidence he indicated that his call recorded on the transcript of radio communications (which is attached as Appendix 4) at the time 23.36.35 was for the curve outside and east of Milton.) At Winston Churchill Blvd. he can see the whole train for a period but his view is cut off by trees

and bushes in places and he is pre-occupied by signals, switches and crossings from some time before Derry Road right through Streetsville. He would take a glance at Britannia Road (mileage 21.41) and again after he had crossed the Credit River and again after passing McConnell Road (mileage 18.65). The major inspection to the right or south was, however, at Winston Churchill Blvd. and the major burden of that was left to Krupa who crossed over to the right-hand side to inspect. He said he always "highballed" the Winston Churchill curve.

Conductor Nichol said that with a full crew one inspects from the rear every station but with a reduced crew it is difficult to do more than every second one. He inspected at Milton as best he could but did not give a highball until he was past the curve east of Milton. Thereafter there was no inspection until close to Winston Churchill Blvd. He then went out on the platform to inspect the train on both sides, and returned into the van at Winston Churchill Blvd. just as the engineer was calling the mileboard at Streetsville. He acknowledged the call and thereafter remained in the cupola except for one descent to check the order board at the Streetsville station. He said he gave the highball for the Winston Churchill curve after the van had passed Derry Road. He did some changes from side to side in the cupola and in fact was in the act of

changing from the north side to the south side at Erindale Station Road when the train went into emergency, causing him some slight injury. He says he checked the rear from time to time including at Burnhamthorpe and saw no markings indicating dragging equipment along or beside the track.

The head end trainman Larry Krupa said he could see at least 50 cars with running gear on the Winston Churchill Blvd. curve, that as a practice he goes over and looks back at that curve from the engineer's side but is back on his own side well before Derry Road, that thereafter he glances at available opportunities on his own or left-hand side including Reid's Mill (mileage 20) and the Hydro Road (McConnell Road, mileage 18.65). He has never crossed over or been instructed to do so at Derry Road or any place east of Winston Churchill Blvd. to Mavis Road. Mr. Parsons, the conductor of the "meet" at Nissouri, said he would inspect the south side just before Eglinton and Mr. Lemon, the engineer of the "meet" at Puslinch, would expect the head end trainman to cross over to look back after the Eglinton crossing is passed.

## 7. THE TRANSCRIPT

The head and tail end are, of course, equipped with radios for communication between them. The engineer's is of 25 wattage but the conductor's is only of 5 wattage

apparently on the principle that only one radio need be powerful enough for communication with the dispatcher. These communications are on a frequency receivable also in dispatching offices and accordingly can be recorded and transcribed. The difficulties however appear to be that some of the engineer's calls are missed because they are simply not within range and many of the conductor's calls are lost for that reason or because of the low wattage. Also some communications are overridden by more powerful or closer calls of other trains on the same frequency.

The main purpose of having the train on a frequency heard in a dispatcher's office is not apparently for monitoring purposes but for communication between office and train. While the equipment is capable of recording those communications heard, it is not intended to be a transcription of every communication. Whether it should be, of course, is another problem to be dealt with later.

With these limitations in mind we should examine the transcript of radio communications recorded for the help it can afford us.

Appendix 4 (Exhibit 115 at the Inquiry) records the conversations received at the Toronto dispatcher's office relative to Train 54 from Guelph Junction to Mavis Road.

It appears to show the following:

1. A highball from engineman to conductor on leaving Guelph Junction.
2. A highball from engineman to conductor at Milton.
3. A calling of the Streetsville mileboard by the engineman.
4. An acknowledgment of the previous call by the conductor.
5. A "highball Streetsville" from the conductor.
6. An acknowledgment of the previous call by the engineman.

It is certainly possible to infer from these excerpts the following:

1. There was no call at the Milton mileboard as required by the rules.
2. There was no highball given or received with respect to the curve at Winston Churchill Blvd.

but it is not possible to conclude as much. First of all there are the limitations of the equipment described. Secondly, the crew maintain stoutly that they did highball the Winston Churchill curve. They did not know it by that name but as the curve "at the top of Streetsville" and the communications numbered 5 and 6 above could be the highball of the conductor given after Derry Road but referable to the whole curve and the acknowledgment of that highball. I can

only regret that the inadequacy of the equipment and the total lack of uniform language requirements in the communications, makes it impossible for us to determine the precise facts.

## 8. THE TEST TRAIN RESULTS

On December 8, 1979, CP Rail under the direction of the London Division Superintendent G.A. Nutkins, operated a test train over the track with a light fixed on or close to the appropriate place on a tank car 2,167 feet 2 inches from the engine (the actual distance on November 10th was 2,163 feet 7 inches) which for this purpose was the same GO unit as that of Train 54. The train was run at night at 50 miles per hour in conditions similar to those that prevailed on November 10th. Three tests were made, the first from Guelph Junction to Mavis Road with observations made from the south doorway of the GO unit, the second over the same territory but with observations from the open window at the engineman's position on the south side, and the third from Streetsville to a point east of Mavis Road with observations from the north side window and in this last test the light was relocated on the north side of the tank car. The results of these tests were as follows:

For test 1, between Winston Churchill Blvd. and Derry Road the light was visible for almost 49 seconds and not seen for an equivalent period. From Derry Road to Eglinton Avenue the light was visible for a total of 17.7 seconds in a total travelling time of about 5 minutes. In test 2, the light was slightly less visible to Derry Road and slightly more visible thereafter. The three places of visibility after Derry Road are as the tank car negotiated the curve west of Derry Road, the curve west of the Streetsville station and the curve between the Credit River and Eglinton. On test 3, the light was not visible at all until the train approached Burnhamthorpe Road.

Although every effort was made to simulate conditions of observation of the crew of Train 54, actual identity could not be achieved for many reasons. First of all the conditions for observation are always better when one is looking for something known to exist and one is not distracted by other duties. On the other hand the light given forth was only 12 volts and the light from the hot box may have been considerably brighter and may have extended out laterally making visibility easier.

## 9. THE CULLEN VISIBILITY TEST

Another test was made to determine the visibility of a hot box at night. This one was undertaken

by Dr. A.P. Cullen, a professor of optometry with formidable qualifications who is now on the staff at the University of Waterloo. An attempt was made to simulate a burning hot box distant 2,167 feet to the rear. The flame was placed directly to the rear of the engine in the place where it would be on straight or tangent track, i.e. the box itself was out of sight of the cab. It was found that the fire that was induced was clearly visible from the cab of the GO unit either by direct observation or through the rear-view mirror. This would seem to indicate that on the straightaway without benefit of any curve whatever, a burning hot box would be visible. Yet this test too must be viewed with caution. No attempt was made to simulate the working conditions, particularly the actual movement of a train at 50 miles per hour. Moreover the test was conducted with the lid of the journal open apparently on the basis that it had to be if the McGregors' evidence of the flames shooting out was to be accepted. There is, however, no direct evidence that the lid was in fact open.

## 10. THE EVIDENCE ON THE GROUND

The first untoward marks on the rails were found just east of mileage 18.3 between McConnell (or Hydro Road) and Burnhamthorpe. The first marks were to the spikes and outside base of the south rail. At Burnhamthorpe there were heavy marks on and adjacent to both rails. These marks

continued and were especially heavy at the crossings and frogs and switches, (a frog in railway language is a connection between the main track and the track leading into it) until at Mavis Road the derailment occurred. It seems to be common ground that the truckside on the south side dropped at the first mark, that the R1 wheel rose up and over the south track at Burnhamthorpe bringing the north wheel over to the south side of the north track. The two wheels and axle continued to move to the south side and somehow escaped entirely from the truck into the Riddels' backyard. This brought the left rear truck side down as well so that both rear truck sides rode along the ties with the car still being carried along with the forward truck still in place and the leading wheels of the rear truck still on the track. At Erindale Station Road the car managed to pass the crossing and the north truck side managed to survive a frog although the frog was damaged. Shortly thereafter the south truck side hit what is known as the Erindale team track switch and damaged it. One theory is that the car derailed there, but the theory is hard to support in light of the evidence of witnesses at Wolfedale and Mavis, particularly that of Mrs. Dabor. It is probable, however, that the front wheels of the trailing truck derailed at this point to the south of both the south and north rails. The car continued in this fashion through Wolfedale Road to a point where there is a switch to the

Alkaril Chemical Limited building just west of Mavis Road. There the whole rear truck was pulled out causing the derailment.

I should add that various parts of journal box steel, brake shoes, journal wedges, bearings and lubricator pads and truck springs were found along and adjacent to the track particularly in the neighbourhood of crossings. As noted earlier, the rear axle and wheels were found by Mr. and Mrs. Riddel near Burnhamthorpe, and the burnt-off journal stub by P.C. McConnell near Wolfedale Road. Both truck assemblies and the three remaining wheel sets were found at or near the final resting place of Car 1, but separated from the car.

## 11. THE SPEED OF THE TRAIN

As will be noted later, the speed limits for trains are, generally speaking, set by the railways. For a train the size of Train 54 the CP timetable as previously noted requires a speed of 15 miles per hour going through the spring switch at Guelph Junction. There is a limit of 45 miles per hour on curves from Guelph Junction to Milton, but otherwise the limit to Mavis Road is 50 miles per hour. Engineman Pruss testified that he did not at any time exceed the limit. CP Rail filed as an exhibit a chart showing the

calculated speeds of the train through various portions of the trip from London to Mavis Road based upon the dispatcher's records, the chart recorder times (taken by machine along the route) and from the radio transcripts. The speeds calculated from Guelph Junction and points eastward to Mavis Road varied from 40 miles per hour to just over 50 miles per hour.

## 12. THE TRAIN OPERATIONS SIMULATOR TEST

This test was conducted by Mr. Gordon English, a Professional Engineer with the Canadian Institute of Guided Ground Transport, a research institute mainly involved in railway issues. From the known lengths and tonnage of the locomotives and the first 32 (or non-derailed) cars and the known track profile and certain resistance and braking factors calculated for each car, he was able to calculate the stopping distance at assumed speeds upon the application of the emergency brakes. Upon a derailment the brake hose will separate and immediately the train will go into emergency. Depending therefore upon the point of derailment and the stopping place of the train, one can calculate the speed of the train at the point of derailment. His calculation included the possibility (based largely on the evidence of Dr. Carey, supra, that he had seen a dangling brake hose at Erindale Station Road) that there had been a

break in the brake hose operating the emergency on the front end of the train but for some reason (perhaps the pinching of the mate to the dangling hose) the rear end did not go into emergency.

Engineman Pruss gave evidence that the lead locomotive came to a stop at a point just short of a certain signal point which was calculated to be at mileage 15.43. Under Mr. English's calculation then, assuming an uncoupling of the hoses at the Alkaril switch just west of Mavis Road, the speed of the train at the time would be 54 miles per hour. Assuming an earlier uncoupling the speed would be greater; indeed with some assumptions the train at much greater speed would have stopped much earlier and some of those assumptions can be discarded. In light of all of the visual evidence (except possibly that of Dr. Carey) it is reasonable to suppose an uncoupling and a full application of brakes at or near Mavis Road, and consequently we should consider the test result figure of 54 miles per hour.

That figure cannot be accepted as certain and Mr. English does not make that claim. The test is not universally accepted, the figures for all cars while close are not precise and there can be a variation of up to 15 per cent in some of the calculations. In the circumstances it would, in my view, be unsafe on the

basis of this test alone, or indeed upon all the evidence, to assume that the speed of the train was any greater than the 50 miles per hour maximum attested to by Engineman Pruss and laid down in the CP Rail timetable for a train of this size at this location. I should state that I am not applying a criminal burden of proof. What I am saying is that I cannot be satisfied that the speed at the time of the derailment was greater than 50 miles per hour. On the other hand, I would have difficulty in being satisfied that it was any less. I shall have something to say about the propriety of that speed later.

13. LOOKING FORWARD v. LOOKING BACK

This problem arises out of a possible conflict in the rules relating to the duties of the engineer and the trainmen, particularly the latter when the train is travelling through urban areas. Those areas carry with them many crossings, signals and switches. Indeed between Derry Road and Mavis Road inclusive there are 11 crossings, 5 signals, 8 switches, a station where train orders may be waiting, and a bridge over the Credit River where children and others might be trespassing, all requiring the attention of the head end.

The Operating Rules (supra, Rules 90A and 111) create the conflict. The former seems to require the constant attention of trainmen to the front at points of difficulty and the latter requires these same trainmen "when practicable" to make "frequent inspections of their train". Neither the CPR's General Instructions or the Chessie System's operating rules seem to resolve the conflict. Mr. Nutkins, the superior of the crew of Train 54, was clearly of the view that the duty to look ahead takes precedence and a trainman who failed to keep a vigilant lookout ahead in order to look back would be in breach of the rules. Mr. J.P. Kelsall, the CP Superintendent in Sudbury, on the other hand, agreed that the "principal function of the head end trainman is really during the operation of the train to be inspecting both sides of the train" and "when the engineman's duties are occupying him with the operation of his train, the head end trainman will be crossing back and forth carrying out running inspections". One can be forgiven for inferring a different interpretation of the rules or at least a different emphasis in Sudbury from that in London. The trainman's dilemma is surely not to be resolved by geography.

## 14. TYPICAL v. QUICK BURN-OFF

There is just one more problem to state before we leave the train's fateful journey. That involves the

consideration of the development of the hot box and particularly whether it was a "typical" or a "quick" burn-off. We will discover that the hot box is one of the most (if not the most) common causes of derailments and yet it is remarkable how little evidence we were able to muster on the progress of hot boxes. One witness who did attest to the subject was Mr. Edward H. Wright, now a railroad consultant, but with over 40 years' railroad experience, much of it with the New York Central now part of the Penn Central System, and much of it concerned with the investigation of derailments. He said that in his opinion Train 54's was a typical burn-off, one normally extending 18-20 miles from first ignition to burn-off and detectable by a slight taper of the burnt-off stub or nubbin, by the fact that the edge of the break is rounded and the core of the break-off is larger in diameter and the fractured surface is smaller. A quick burn-off which has little or no taper, he said, is now rare being the product of the reconditioned journal now outlawed. On the other hand, Mr. R.W. Barratt, Chief Equipment and Facilities Assessment, Ontario Region of the Railway Transport Committee of the CTC, on examining the nubbin and finding its diameter 5 13/16th inches at 7 1/2 inches from the collar, and 5 15/16th inches at 1 inch from the collar concluded that it was a quick burn-off. I should say in passing that the Ontario Research Foundation's precise measurements of the stub shows a diameter of 5.81 inches

at 7 1/2 inches from the collar and 5.98 inches at 1 inch from the collar. That is a taper certainly, but whether it is pronounced enough to indicate a typical burn-off, I cannot say—none of the literature before the Inquiry indicated how much of a taper is necessary to signify a typical burn-off nor how little will signify a quick burn-off. We also did not have the benefit of Mr. Barratt's evidence to explain how he reached his conclusion. No one is to blame for that omission; there occurred to no one that there was a discrepancy in his report and the evidence of Mr. Wright until after argument had commenced.

The significance of the discrepancy is this: if it is a typical burn-off then in Mr. Wright's view the whole process will be in operation from Guelph Junction and the fire which at first will be intermittent will be constant by Winston Churchill Blvd. If it is a quick burn-off then the fire seen by the McGregors at Derry Road (and not seen by the Misses Bota and Carter at Streetsville) may have been only intermittent at Derry Road and not even that at Winston Churchill Blvd. I prefer not to resolve this question on the opinion of experts, only one of whom was subject to cross-examination. I prefer to make deductions from the evidence of the eye-witnesses and I shall do so later in this report.

# V. THE RESPONSE

## 1. THE CREW

The transcript records Engineman Pruss's words at 23.54.27 "We're in the big hole Ted, but still moving" and 20 seconds later "Jesus Christ Ted, one of them tank cars blew up...". The first excerpt is a report of the train going into emergency (the big hole) and the second is his observation of the bleve of Car 8. I repeat that "bleve" is an acronym for Boiling Liquid Expanding Vapour Explosion. He radioed immediately to report it and finally reached both the London and Toronto dispatchers. By the time he had stopped his head end was at mileage 15.4 being 1.2 miles east of Mavis Road and the 32nd car which, of course, was uncoupled from the 33rd car was approximately 3,900 feet east of the resting place of Car 1 which was 250 feet east of Mavis Road. Krupa volunteered to go back to close the angle cock on the 32nd car so that the air pressure could be built up through the head end of the train permitting it to pull away. After he had done this, Pruss did pull away a distance but there then came the second explosion and at Krupa's request he pulled further to the Cooksville Station at mileage 14.2 and stopped. Krupa did some flagging for westbound trains and subsequently they proceeded with the 3 units and the 32 cars to the Lambton yard. They returned to London the next morning; they did not return to the scene.

Conductor Nichol as above reported was in the act of crossing from the north to the south side of the cupola when the train went into emergency. He took his consist list (in the emergency he forgot the Emergency Response Forms), his radio and some flagging equipment and ran west to Erindale Station Road. He placed some warning devices on the track and tried to keep people away from the train. He then ran back to Wolfedale where he showed his consist list to a fireman and a policeman. The latter took him to the temporary control centre where he informed a fire chief that there were 24 cars in the derailment and marked them off on the consist. Not unnaturally he was unable to identify the Chlorine car on the ground and he was not permitted to get the Emergency Response Forms until about 2:30 a.m. He too returned to London the next morning.

## 2. THE RAILWAY

As the transcript indicated one of the dispatchers on duty in London was Mervin Wallace but the chief night dispatcher was Bill Kent upon whom fell the duty of taking steps in the emergency. The railway provides a flow chart which instructs dispatchers whom to call. Among these are the local fire and police departments, the Bureau of

Explosives (an arm of the Association of American Railroads), the Superintendent and other officers of the railway, the Canadian Transport Commission and perhaps most important the appropriate parties for emergency response. All of these parties were indeed notified or at least an attempt was made at notification. Mr. Nutkins himself was notified about 0030 on 11 November and by 0130 was on his way to the scene. There he found Mr. L.A. Hill, the general manager of the region, and numerous officers of the Toronto Division. They were questioned by the fire and police departments on the location of the Chlorine car but could, like Nichol, reply only by giving its original position among the derailed cars. They were able to remove the rear 25 cars to Guelph Junction without difficulty. Of the remaining cars west of the derailment, 4 were partly or entirely derailed, and the rest were on the rails. By the afternoon of that day all of those cars had been removed to Guelph Junction or Streetsville. During the following days Mr.Nutkins supervised work crews in repairing the site and removing debris and cars when permitted to do so—sometimes there was work done so close to the scene as to cause some consternation among those seeking to prevent chemical injury. On Sunday November 18th, when the track had not been entirely cleared, a diversionary track or shoo-fly was built. On Monday Mr. Nutkins returned to London.

Messrs. Hill and Nutkins were by no means the only CP employees on hand. Indeed there were over 200, largely trackmen, carmen and signalmen from London, Toronto and Windsor. Among the officers in attendance were Mr. G.E. Lepage, the Supervisor of Dangerous Commodities, and Mr. R.S. Allison, Vice-President of the Eastern Region, and from Montreal Mr. W.W. Stinson, the Executive Vice-President of the railway.

Mr. Nutkins complained bitterly both at the time in a report to his superiors, and before the Inquiry in his evidence, of his exclusion, indeed the exclusion of all CP personnel from the decision-making process in the early stages. It seems that he and Mr. Hill were asked to participate in a meeting to be held on Tuesday and then denied access at the door. He stated that the railway had many contacts and much expertise that could have been available and by the exclusion was lost. I did not permit the Inquiry to delve into the matter deeply and no evidence was offered as to any particular benefit lost, but there is no question in my mind that if CP officials were excluded, it was a mistake.

Certainly the exclusion was not permanent. It was obvious from transcripts of command post proceedings that Mr. Allison was a part of the command team from Thursday, November 15th on.

Mr. Lepage, the Director of Dangerous Commodities for the Eastern Region, has a background as machinist, foreman and mechanical supervisor for CP Rail. In 1975 he was made Director of Dangerous Commodities with duties to attend derailments and guide and supervise if dangerous commodities are involved. As it happened he was on holiday in Ottawa on November 10-11. He was reached late Sunday morning and drove back to Toronto immediately, arriving at the scene about 9 p.m. that night after a detour (requested by his superior) to give a television interview. His principal task was to warn CP employees and others on the site of the potential dangers of the dangerous commodities involved. He readily admitted he was not an expert in the properties or control of dangerous commodities particularly Chlorine, but he did assist or offer to assist the members of the private response teams and his activities there are better left to be considered with the activities of those teams. Certainly he was not a member of the command post team.

## 3. THE MUNICIPAL EMERGENCY SERVICES - FIRE & POLICE

Both the fire department of the City of Mississauga and the Police Department of the Region of Peel were on the job and on the scene immediately after the derailment. The fire department set up hoses on both

sides of the track and manned them continuously until the fires were out and were available at all times thereafter. The police took charge of the scene to keep the citizens free of danger and executed the very difficult evacuation and re-entry programmes. While the authority and capacity of these departments may be within Item 6 of the terms of reference, I did not consider that the quality of their performance was within my mandate and I refused to issue subpoenae to the fire and police chiefs which subpoenae seemed to me directed to that assessment. I content myself with saying that I heard no complaint about the manner in which the police executed their difficult task, and the only complaint voiced about the firemen was that they were inclined to approach the fire too closely for their own safety. It is a transgression I find very easy to forgive.

## 4. THE PRIVATE SECTOR

The transportation of dangerous commodities by rail is big and necessary business. It is estimated that there may be as many as 300,000 different dangerous substances capable of transportation, but only some 3,500 are commercially significant and 30 constitute the bulk of

those transported. These include explosives, compressed gases, flammable—the word "inflammable" has fallen into disuse in North America, apparently because of confusion with "non-flammable"—liquids and solids, toxic substances and corrosives. Some, as we shall see, are much more dangerous than others but regardless of danger, many have great commercial use and most of these are transported by rail.

The dangerous commodities involved in the Mississauga derailment more or less in order of magnitude of danger were:

(a) Chlorine
(b) Propane
(c) Toluene
(d) Caustic Soda
(e) Styrene

Styrene, a solvent used in the manufacture of pharmaceuticals, plastics and automotive parts is not classified as a dangerous commodity in Canada although it is in the United States. The others, all classified as dangerous commodities, have many and valuable commercial uses including Chlorine for water purification and bleaching of pulp and paper, Propane as a fuel, Toluene in paints, fuels, clothing and furniture, and Caustic Sode in textiles, paints and disinfectants.

These products are not only needed but must be transported because they obviously cannot be manufactured

everywhere. Some suggestion was made that there could be a reduction in transportation by using the product where made or at least avoiding the transportation of chemicals from one place of manufacture to or close to and for use at another place of manufacture. It would not, in my view, be practical to attempt such a solution by legislation. Not only would it be an interference in a free market economy, but that very free market, if our theories are correct, should eventually produce the cheapest method of distribution which will involve the least transportation.

The problem that arises in the transportation of dangerous commodities is not just the danger. It is the ignorance of the layman in the properties of the commodity and in consequence his inability to control the escape of that commodity or to take appropriate protective action upon that escape. This deficiency can be corrected only to a limited extent. The municipal services can be educated (and indeed steps have been taken already by the railways, private industry and government to that end—the above mentioned Emergency Response Forms are an example) and I will recommend that such education extend to all railway employees concerned in the transportation of dangerous goods and all firemen through whose municipalities dangerous commodities may pass. But such education or training can

never be enough. Where a dangerous spill occurs there must be on the scene someone or some group capable and qualified to take the necessary action.

## 4.(a) CANADIAN CHEMICAL PRODUCERS ASSOCIATION AND TRANSPORTATION EMERGENCY ASSISTANCE PLAN (TEAP)

Private industry has recognized this need and government is recognizing it more and more. The Canadian Chemical Producers Association in 1972 established the Transportation Emergency Assistance Plan (TEAP) which operates Regional Control Centres located at the various companies in British Columbia, Alberta, Ontario and Quebec. Its purpose is to provide immediate expert advice to people at the scene and then to arrange for a shipper to provide more detailed assistance. It operates a 24-hour telephone service at the Regional Control Centres with a technical adviser who remains available until the shipper has taken over.

## 4.(b) THE CHLORINE INSTITUTE AND CHLOREP

Of a similar nature is, dealing with a particular industry, CHLOREP (The Chlorine Emergency Plan) established on a North American basis by the Chlorine Institute which

has its headquarters in New York and has amongst its members virtually all manufacturers of Chlorine in North America and many manufacturers from overseas as well. The Institute has many committees of which the important one for us is the Chlorep Committee established in 1972 which controls the Chlorep plan. By that plan the United States and Canada are divided into sections, each with at least on Chlorep team operating or prepared to operate on a 24-hour basis to handle real or threatened Chlorine leaks. These teams are located at the major manufacturers, one of whom is the Dow Chemical plant at Sarnia which was, as it happens, the shipper of the product in Car 7.

(i) DOW CHEMICAL OF CANADA LIMITED

It was the Dow number that was called by the London dispatcher on the morning of November 11. He called plant security at 0149 hours and plant security notified Mr. R.W. Johnson, the manager of the Product Services Department of Dow who has been the Emergency Response Coordinator of both the TEAP and CHLOREP plans for Dow since 1974. There was, of course, at Dow in existence a Chlorep team and Johnson alerted that team consisting of Mr. Ralph Jones as Captain, Mr. R. Robichaud experienced in firefighting, and Mr. D. Hamilton experienced in public relations. He also alerted Mr. Stuart T. Greenwood, the supervisor of the shipping department, who had had practical experience in a Chlorine spill at Loos, British

Columbia, in 1973, a derailment involving a puncture of a Chlorine car and consequent escape of gas, but without accompanying fire, and also at Youngstown, Florida, in 1978 where in another derailment a Chlorine car had been punctured but again without accompanying fire. The team with Greenwood in charge left Sarnia at 0330 and arrived at the scene at 0630 hours. Immediately on their arrival, they detected a smell of Chlorine but were unable to get to the car to determine the source of the leak. Indeed, even with the help of a helicopter tour over the site, they were unable that day to discover the exact location of the car itself.

Greenwood did notice that the firemen were much too close and suggested they move back. Generally speaking he was unable to take any corrective measures that day because of the intensity of the fire and the danger of further explosion. He was, however, asked by the Provincial Ministry of Environment officials to get information on the worst possible results of the escape of Chlorine. Knowing that the capacity of the car was 90 tons and the wind was 17 miles per hour, he sought and obtained from Johnson dispersal figures and safe evacuation areas which he communicated to the command post and upon which the evacuation orders were no doubt based. The figures were shown on Exhibit 186 and are to the effect that to avoid

long-term health hazards in the event of release of the full contents, it would be necessary to evacuate an area of 16.5 miles by 2 miles and in the event of a release of only 18,000 pounds, the evacuated area should be 3.5 miles by 1/2 mile. As will be seen the first figure appears to have been the basis for the evacuation ordered on Sunday, and the second for the reduced area on Tuesday. Greenwood also was informed that the Ministry was unable immediately to take Chlorine readings in the air and asked for and obtained two more men from Sarnia properly equipped for the purpose. As it happened the Ministry did have the necessary personnel and equipment available on Sunday and readings were taken by them throughout the week. I should say now that at no time were dangerous readings recorded anywhere in the area but that, of course, is not the whole story. It is not the present but the potential danger that must govern, when human lives are at stake.

Robichaud and Jones located the Chlorine car on Monday morning, and saw that it did indeed have a hole and a large one at that. The hole was 2 1/2 feet in diameter, the largest ever experienced, at least on this continent. Greenwood and his men examined the hole with protective equipment, took pictures of it with the assistance of Detective Boyd Brown, covered the hole with a tarpaulin and proceeded to a tank car manufacturer at Bronte, namely Procor Limited,

where a patch was prepared immediately. The fires were still burning that day and no attempt was made to apply the patch. Greenwood did, however, report to the Attorney General who was in charge of the command post that there was this large hole but added that there was not so much Chlorine as he had feared remaining in the car. He had determined this by measuring from the surface of the hole to the surface of the Chlorine remaining. His figure could not be exact, however, because ice had formed on top of the liquid Chlorine and the depth of that ice could not be calculated.

(ii) THE NATURE OF CHLORINE I pause here to say something about the nature of Chlorine and its manner of transportation. It is itself non-flammable but acts as a supporter of flame. At normal atmospheric pressure it boils at -30° F, but the greater the pressure, the higher the boiling point. It is loaded at 40° F, with a pressure of 50 pounds per square inch, mainly in liquid form, but with some in gas form to prevent damage on expansion of the liquid into gaseous form. If indeed the liquid does boil and convert into gas, it expands by a factor of 460. When there is a hole in a tank car inevitably there will be a decrease in pressure which lowers the boiling point, increases the volume and causes an escape of vapour. After that escape, however, an equilibrium is reached with some of the vapour being returned to liquid form and in the absence of any

heat source other than that provided by the atmosphere the rate of release would thereafter be very slow.

Another property of Chlorine should be mentioned. As I have said, it is not in itself flammable, but carbon steel containing Chlorine will have a reaction at 483° F, which reaction is known as a ferric chloride reaction whereby the steel will burn and disappear in a form of very fast oxidation.

Finally, water can have an effect on a Chlorine tank car. First it is inadvisable to water a tank car having a small hole because the combination of Chlorine and water will create an acid that corrodes and enlarges the hole. And in a very large hole such as existed in Mississauga, water may get in and form an ice layer (hydrate) on top of the liquid as it did in Mississauga. This may have detrimental and beneficial results. The latter comes about by the insulating effect of the ice layer and the former would be demonstrated if there were chinks in the ice layer allowing some gas (liquid converted by the heat of the layer) to escape. The ice layer is known as chlorine hydrate and was one of the unusual features and one of the complications as we shall see first in determining the amount of Chlorine remaining and second in predicting the danger in evacuating the Chlorine from the car.

(iii) THE EVACUATION OF THE CAR The fires were out in the early morning of Tuesday, the 13th, and Greenwood, with the Procor patch, proceeded to attempt to evacuate the car of its Chlorine. The first attempt consisted of patching and then pressuring the car and trying to pump out the Chlorine into a Chlorine truck standing by, somewhat in the manner of what had been done in Loos with a much smaller hole. Unfortunately when the pressure was applied, the patch did not hold. Greenwood and his team worked all Tuesday night to repair the patch—the decision to work all night was perhaps dictated by the intention of others to do work on a Propane car nearby the following morning and the desire not to be working in the vicinity at the time. The patch was repaired, or virtually so, by 0800 hours on Wednesday, but no further attempt was made at evacuation; instead the team retired to bed in exhaustion, having first asked Sarnia for more help.

That help came in the form of Mr. Fred Hamlin, the Chlor-Alkali production manager and a chemical engineer, and 2 other men (later a third) from Sarnia, as well as 3 technical personnel from Canadian Industries Limited (CIL). From the time of his arrival on the scene, Hamlin was in charge of the Dow operation.

By the time Hamlin arrived, the idea had occurred to attempt to vacuum out the Chlorine as opposed to pressurizing. This was performed with the liquid being removed first to a tank truck and then to a tank car and the Chlorine vapour being coincidentally neutralized in Caustic Soda. There was some delay because the command post was worried about the wind direction and the possibility of some disaster occurring in the course of the transfer. However, the evacuation of liquid did commence at 2315 hours on Thursday and was completed without incident in the early morning of Monday, November 19th, when the tank car was filled with water and the patch removed. The remaining evacuees in Mississauga were permitted to return home on Friday, November 16th, at which time the command post deemed that operation to be safe.

(iv) THE ALLEGED DEFICIENCIES OF DOW'S CHLOREP TEAM

A massive attack was launched upon the performance of the Dow team by counsel for CP Rail. As I understand the complaint it is as follows:

1. Dow sent to the scene an unqualified and inadequate team.

2. Greenwood and his crew did not know how to evacuate the Chlorine.

3. Greenwood and his crew did not know how much Chlorine remained in the tank car after the initial escape and did not know how to calculate it.

4. Greenwood and his crew gave improper and dangerous instructions to firemen to water the Chlorine car and indeed watered the car themselves.

5. Greenwood failed to take measures to vent the car at the beginning to protect against escape of Chlorine.

6. Greenwood (and Hamlin) gave poor advice to the command post team, particularly with respect to the rate of vapour and liquid evacuation, as to the method of evacuation and as to the dangers of release of gas consequent upon breaking of the ice.

7. Greenwood (and Hamlin) were parties to the concealing of information or the rendering of misinformation to the public.

There were many motions made before me in the course of the Inquiry and two of them, at least, bear upon this problem. The first was a motion by CP Rail to subpoena some of the persons in the command team to give evidence of the decision-making process. I rejected the application partly upon the ground that in my view it would result in a protracted delaying cross-examination on largely (to me) irrelevant matters, but partly also because in my view

it was the danger or properly apprehended danger with which the Inquiry should be concerned, not the validity of the action taken by the command team in response to that danger or apprehended danger. The second motion was one brought on behalf of Dow which asked, among other things, for an interpretation of Item 6 of the terms of reference as it affected the response by Dow's Chlorep team. I noted that I might not be able to report on the question at all but added that in my view the term "involves the action to be taken by the federal authorities to correct the situation arising upon an accident including the calling upon the private sector for assistance. That may embrace the capacity of the private sector to respond; and whether in the light of the Mississauga experience, the present system should be continued, discontinued or amended."

The Inquiry proceeded without the evidence of those in command at the command post and counsel argued knowing the limitation of my interpretation of Term 6. I was concerned with the danger or properly apprehended danger facing Mississauga, not with the validity of the reaction to that danger or the measures taken to combat it. I was concerned with the capacity of the private sector to respond and with the system of relying upon private response, not with the manner in which that response was executed. That, no doubt, will be a matter of great interest to others at another time.

That being so, I need not consider the facts behind the allegations in too great detail. However, a great deal of time was taken up with that detail in the Inquiry and much time was spent in argument in the course of the accusations against the team and in the course of the very vigorous and spirited defence of the team's conduct by counsel for Dow and counsel for the Attorney General, and perhaps I should express some view on the matter. I content myself with saying that I do not think the personal attacks on Greenwood and to a lesser extent on Hamlin and Johnson are justified. Perhaps in hindsight Johnson should have provided for a back-up team earlier and perhaps Greenwood should have asked for it earlier. Perhaps Johnson should have sent Hamlin at the beginning. Perhaps even in light of the magnitude of the disaster, a person of ultimate authority in the company should have been on the scene. Perhaps the knowledge of Greenwood was inadequate for the enormity of the task and perhaps again in hindsight he did not use the best methods at the beginning. But all of these men did the best they knew and their knowledge was better than that of anyone else on the scene. They all, and the other members of the team, worked very hard to correct a situation which was not of their own personal making and they gave the best advice of which they were capable. I may deal very little with some of the other allegations in the course of considering the actions of the command team. With regard

to the last enumerated alleged default, I must say now that I do not accept the allegations that any of these men were deliberately parties to a deception, either of the command team or of the public.

(v) THE POSITION OF DOW Having said that, however, I do not wish to be taken as entirely satisfied with the Chlorep plan of Dow. Nothing in the conduct of the company's affairs can be of greater public importance than their response to a Chlorine spill. It must be remembered that however good or bad that response may be, it is at the moment all we have. It is accordingly of vital importance that its response team be adequate to the task.

Dow has, as we have seen, a predetermined group of people who are designated as the Chlorep team and have computers to give dispersal data. Apparently Greenwood was given some practice training in patching cars and he had the practical training at Loos. Dow also has kits, supplies and equipment and has prepared a detailed, apparently complete Emergency Response System Guide for its employees. That document was filed on condition it not be made public and will be returned to Dow on the completion of this Report. I have examined it and find it replete with information where technical assistance can be obtained, but empty of technical assistance itself.

That is indeed my concern. The team was completely surprised and quite unprepared for a hole the size of the one that developed in Mississauga. It was not experienced in dealing with repair work in the presence of fire. Is the training of the Chlorep team——which is voluntary; the Chlorine Institute runs seminars but attendance is not required——sufficient? Is it sufficient to rely on the experience of the men designated, that experience being obtained in their ordinary jobs or should there be some specialized training in simulated disaster settings? Is it enough to have practical men only compose the Chlorep team in the first instance or should there be a technical man thoroughly knowledgeable of the properties of the particular chemical as part of the team from the first?

I pose these questions; I do not answer them. As will be seen I shall recommend that these problems be considered by a qualified person and that the plan of response be approved and the rules be established before any shipment be permitted.

(vi) THE CHLORINE INSTITUTE REPORTS I should here note the history of rail spills of Chlorine in North America as revealed in the Chlorine Institute Accident Reports issued for its members.

Labarre, Louisianna. The first in point of time was that at Labarre, Louisianna on January 31st, 1961, when a Chlorine tank car of the 105 series was punctured by a draw bar at the B end and the whole contents of the car apparently spilled into neighbouring ditches. The hole was stated to have an area of about 4 square feet. There were about 100 human casualties and 1 death. It was also stated to be the first known puncture in the 52 year history of Chlorine tank cars.

Newton, Alabama. The second spill was that at Newton, Alabama, in 1967, where a Chlorine car, one of 51 cars, derailed. The derailment produced a fire that raged for 20 hours and the Chlorine car suffered an 18 inch hole in the shell and a 6 inch hole in the B end, both believed to have been caused by ferric chloride reaction. When it finally became possible to approach the car, it was found that all the Chlorine had gone, believed to have been carried into the air by the conflagration and dissipated in the upper atmosphere. There were no casualties but 2,500 people were evacuated.

Corbin, Louisanna. The third spill was at Corbin, Louisianna, on December 11th, 1971, where a Chlorine car was derailed and suffered a blow from the coupler of the car ahead creating 2 small holes in the jacket, one of which cut a slit in the head of the tank 3/16th inch by 1/2 inch. From this hole

Chlorine was leaking and the leak could not be repaired. The Chlorine was transferred to an empty car and with the aid of some caustic soda neutralized. The Chlorine in the air never reached any dangerous levels and there were no casualties.

Loos, British Columbia. The fourth spill was that at Loos, B.C., on March 4th, 1973 which Greenwood attended. 24 cars including 4 Chlorine tank cars of a CN train were derailed. One of the Chlorine cars suffered 2 punctures, one 3 1/2 inches by 6 inches and one 6 inches by 4 1/2 inches. It appears that 17 of the 85 tons of Chlorine in the car escaped through boiling off, spillage and venting, and the remainder was pumped off, after patching, into a waiting tank car. There was only one minor casualty. The Institute in its report recommended that Emergency Kits should have pre-made patches, fasteners, pumps and other equipment. The Chlorep team did not arrive at Mississauga with a pre-made patch and Greenwood stated it would be useless because all patches had to be made to fit the configuration of the particular hole and the particular car. It must be recognized, of course, that no time was lost by any lack of equipment in the Chlorep team at Mississauga because the fire prohibited any repair work until Tuesday morning.

Youngstown, Florida. The last and most serious (before Mississauga) spill was at Youngstown, Florida, on February 26, 1978 at which as we have seen Greenwood also attended. 44 of 140 cars including 2 Chlorine cars derailed and 1 of these suffered an irregular shaped puncture about 3/4 of 1 square foot in size. About 50 tons of Chlorine was lost in the first few minutes. There was very little wind and the cloud drifted to a nearby highway killing 8 motorists and their passengers. Some 89 persons were hospitalized and hundreds affected. It was decided that the hole could not be patched and the remaining Chlorine was pumped out (and neutralized by Caustic Soda) into a large pit dug for the purpose.

## 4.(c) THE PROPANE RESPONSE

Whatever may or may not have been the defects in the Chlorine response, it at least was available and immediate. The same cannot be said for the response of the Propane industry generally. Propane constituted the second greatest danger at Mississauga and in fact caused by far the greatest damage to property. The Canadian Chemical Producers Association originally had a cooperative arrangement with the

Propane Gas Association but has ceased to make any claim to that arrangement because it is said that that latter Association does not maintain a 24-hour telephone. Indeed, it appears that Johnson of Dow in the early hours of Sunday tried to reach the Propane Gas Association through an intermediary but was unsuccessful.

It is to be remembered that 11 of the 24 cars derailed contained Propane and that 3 of these cars, numbers 8, 12 and 13, bleved within one-half hour of the derailment. Propane is one of the family of Liquified Petroleum Gases or LPG's. It is not only explosive but also flammable and indeed most of the fire at Mississauga was the result of the burning of Propane. Of the 8 tank cars containing Propane that did not bleve, 7 were either punctured or ruptured from within and their contents consumed in fire. One however (Car 23) was found still to contain a large part, if not all, of the Propane intact. As noted earlier there is no response organization for Propane and when Mr. Lepage arrived on the scene on Sunday night he asked that someone be obtained to help deal with the Propane problem. That someone turned out to be a team of 7 or 8 men under the leadership of Mr. David Johnson from Superior Propane, a company having a 24-hour telephone service, and one which, as it happened, was the consignee of bleved Car 12. Johnson appeared on the scene Sunday night but could do nothing until

the fires were out. He approved of the firemen's approach which was cooling the Propane cars and permitting the fires to burn themselves out. Like everyone else he found the firemen to be doing an excellent job. After the fires were out he, assisted by Lepage, supervised the washing out of all the burnt out cars to remove any vapour and the removal of the liquid from Car 23. This was partly accomplished on Tuesday and completed on Wednesday after the car had been righted. The whole operation was conducted under the protection of explosimeters, instruments that will tell of the imminence of explosion. There was also an interruption on Wednesday because of a suspected escape of Chlorine to which I will refer later, but generally speaking the clean-up of Propane was completed without incident. Nevertheless we must not forget the 3 explosions and the fires that raged for more than 48 hours. It is also imperative that the emergency telephone numbers onall Emergency Response Forms be operable on a 24-hour basis. Mr. Wilmer Karaskawich, the manager of the Dangerous Commodities Assessment of the RTC, in a survey conducted between January and October, 1979, found some of the emergency telephone numbers "not functional anymore".

## 5. THE PUBLIC RESPONSE

### (a) THE COMMAND TEAM

I need hardly say that the accident at Mississauga was unlike any other. In the ordinary course an accident will be handled by the railway with perhaps a little help from the Bureau of Explosives of the Association of American Railroads and very occasionally from TEAP or CHLOREP or some such technical organization. But in Mississauga not only were there explosions and fires requiring immediate and continuous firefighting and police control, but the apprehended danger from the Chlorine resulted in the evacuation of nearly a quarter of a millon people. Inevitably the problem became a political one.

The evacuation of the residents is assuredly not among my terms of reference. Also as I have said I refused to subpoena witnesses where the evidence seemed to me to lead only to consideration of the propriety of the decisions made to evacuate them from or to return them to their homes. Still Term 6 does, at the very least, require some consideration of the corrective system in response to an accident and we have had, I think, more than enough evidence to enable me to express my views on how it worked at Mississauga and what could be done to improve it.

There was an immediate response from the City in the person of its Mayor, Hazel McCallion, and from the Province in the person of The Honourable Roy McMurtry, the Attorney General. Mr. McMurtry was (and is) also the Solicitor General and it was in that capacity as Chairman of the Cabinet Committee on Emergencies that he attended the scene and took command—I have no doubt whatever that he was in complete command from the moment he arrived, even though he did not conduct the matter like a military operation. His method was to discuss and obtain agreement, not to issue orders. Everyone at the command post referred to him by his senior title, viz. Attorney General, and I shall do the same.

Among those advising the Attorney General besides the Mayor, were members of the federal and provincial parliaments, the chiefs of fire and police, representatives of the provincial Ministries of the Environment, Health and Labour, the Canadian Transport Commission, Messrs. Greenwood and Hamlin of Dow, Mr. Johnson of Superior Propane, two university professors, and from Thursday, November 15 on, Mr. Allison and others of CP Rail. From this team there issued the orders to evacuate the populace and to return them to their homes, to commence or delay the evacuation of Chlorine and to permit the clean up of the CP right of way. The team also

issued press releases to inform the public, particularly the people of Mississauga of progress, and dealt with a host of other problems that arose during the fateful week. So far as I can determine there was no dissent from the decisions made and the orders issued.

The major problem at all times and the only real problem after the fires were out on Tuesday morning, was the danger to the public posed by the escape or possible escape of Chlorine. What was needed to know was the amount of Chlorine remaining in the car, the rate at which it was escaping, and what the risks were of a greater escape in any effort to evacuate it.

Stangely enough no exact figure could be given of the amount of Chlorine in the car after the initial escape. It appears that the bleve of Car 8——and perhaps the other bleves as well——sucked up much of the Chlorine out of the tank and lifted it into the sky where it was dissipated more or less harmlessly. Greenwood was able to measure to the hydrate level on Monday and reached the conclusion that there was 2 to 3 feet (including hydrate) remaining which, taking into account the total depth of the tank (102 inches) he estimated would leave about 20 tons of Chlorine still in the tank. Later this estimate was revised downward, perhaps after the frost level could be determined, because documents were

circulated at the command post showing that ice (hydrate) was 6 to 12 inches thick and there remained in the car "about 10 tons of liquid Chlorine". More sophisticated methods of determining the quantity were tried throughout the week by x-rays, thermovision and gamma ray. The latter achieved the best results, but none was really satisfactory. The difficulty is that the industry has traditionally used only one method and that is weight, a method that was impossible at Mississauga because the car could not be lifted without running the risk of a sudden escape of Chlorine from the disabled car. By Wednesday (after the patch was on) Greenwood told the command post that there was a "controlled situation", but he could not guarantee that something might not happen to the ice which might cause the release of gas which might in turn destroy the patch.

Hamlin in evidence estimated that there was probably 20,000 pounds left after the initial escape, that about 5,000 pounds was lost until Thursday and that the remaining 15,000 pounds or 7 1/2 tons were vacuumed out between Thursday and the following Monday. Much of the Chlorine was neutralized in the vacuuming process so that the figures of weight of the product transferred to the truck and car (negligible) are unreliable. Hamlin further estimated that there was a loss of about 50 pounds per hour from Monday to Thursday by vapourization and that evacuation after Thursday of both

liquid and vapour was at the rate of about 200 pounds per hour.

(b) WATER ON THE CHLORINE CAR

I should mention here an incident (the same one as referred to in Item 4 of the indictment, supra, against the CHLOREP team) that caused some temporary concern at the command post. Late Wednesday morning a puff of vapour was seen by several witnesses to come from the general direction of the Chlorine car and was assumed by many to be Chlorine. I may say I am far from certain that it was. In any event, it caused a temporary halt in the evacuation of Propane from Car 23 and considerable recriminations at the command post and at the site. It happened while Greenwood and most of his team were asleep and when he was informed of it he blamed it on the inadvertent or ill-advised watering of the Chlorine car, perhaps in the course of the Propane operation. Some of the firemen suggested that it was Greenwood himself who had ordered and arranged a steady stream of water directed towards the area of the patch. Greenwood and others in turn testified that no water was arranged by them to fall upon the patch and the only hoses in the area were sprays to disperse escaping Chlorine. I doubt very much that Greenwood would have

ordered the placing of hoses where water could have entered the car, and I doubt that any of the firemen would have done so against his orders. Whatever happened was a misunderstanding only, but in any event, in my opinion, was of little or no importance in the final analysis. A great deal of water must have fallen on the unprotected hole in the initial firefighting. It is doubtful that that water caused any harm. The hole was so large that the water was unlikely to cause any expansion and the only certain result, i.e. the formation of hydrate, appears to have acted as a seal to prevent or at least inhibit the further escape of Chlorine. As to the alleged additional water entering the car on Wednesday morning, as I say, I am not sure there was any. I am also not sure that there was an escape of Chlorine resulting therefrom and if there was there is absolutely no evidence that it caused any harm to anyone. The only problem with it is that it seems to have caused some alarm at the command post and perhaps affected their view of the danger of the situation.

(c) THE DECISIONS OF THE COMMAND TEAM

As I have said, I do not consider that I have been asked to judge the validity of the team's decisions and I do not intend to do so. All I can say is that they

clearly had a very difficult problem. They obviously had no desire to keep people out of their homes any longer than necessary and the Chlorine readings showed that there was no immediate danger. No one, however, could tell them exactly how much Chlorine remained—all estimates given were of an amount that if it all escaped could be catastrophic—and no one could guarantee that the vacuuming process could be conducted without some danger in light of the hydrate and the unknown condition of the car. As a matter of interest, the examination of the car by the Ontario Research Foundation revealed a dent with a crack in it at the bottom of the A end of the car.

Even in the hindsight of the 127 days of the hearing with much of the evidence and argument dealing exhaustively with the danger presented by the Chlorine car, I am happy that the decisions were theirs, not mine.

## VI. THE TANK CARS

Tank cars for the transportation of dangerous commodities by rail have been with us for more than 100 years. At first, they were wooden barrels on flat cars, then they became metal cars of wrought iron and later of steel. Until the turn of the century the capacity did not exceed 10,000 gallons, but in this century they have become much larger. Indeed for a time there seemed no limit to the increase in size but finally it had to be brought under control because of the effect on track. In Canada it is provided—see CTC Regulation 79.13 that after 1970 no tank car shall exceed 27,500 gallons capacity or 263,000 pounds gross weight. Also in recent years special types of cars have developed for special types of dangerous commodities.

### 1. DEVELOPMENT AND OWNERSHIP

At first also the tank cars were owned by the railways but gradually the manufacturers and the shippers have taken over, generally with the shippers as lessees. The dangerous commodities carried in Train 54 were in cars of the 105 series for Chlorine, the 111 series for Toluene, Caustic Soda and Styrene (the latter not technically a dangerous commodity), and the 112 and 114 series for Propane.

Of the particular cars, Cars 1 and 13 were owned by North American Car Corporation and leased by Shell Oil, No. 7 was owned by Canadian General Transit Company and leased by Dow, Nos. 8 and 12 were owned by Union Tank Car Company and leased by Imperial Oil and Shell Canada respectively.

## 2. DESIGN AND THE RETROFIT PROGRAMME

The design of these tank cars has for many years been regulated, at first only by the Association of American Railroads, but latterly also by government, the Department of Transportation in the United States and the Canadian Transport Commission in Canada. It is sufficient for now to say that by regulation all tank cars in use in Canada must comply with CTC regulations which in turn are generally speaking in accord with the specifications for manufacture established by the AAR. Indeed the Red Book requires that designs, materials and construction be submitted to and approved by the AAR Tank Car Committee.

There are, of course, innumerable features of design in all these cars that relate to safety, but the only ones I think we need deal with are (a) roller bearings and plain bearings, (b) shelf couplers, (c) head shields, (d) thermal protection, (e) bottom fittings, and (f) safety valves. I shall deal with each mainly to show the purpose

of the improvement and the state of the retrofit programme. The term "retrofit" is used in railway circles to denote a programme for improvement of a tank car already manufactured. Sometimes, as we shall see, it is under the auspices of the AAR, and sometimes it has the force of law.

(a) Roller Bearings and Plain Bearings.

Journal bearings, as I have indicated, are a part of the running gear of the railway car and are by no means peculiar to tank cars. Roller bearings have been in existence since about 1950 and in 1966 the AAR required all new 100 ton cars to be fitted with roller bearings and in 1967 the requirement was extended to all new tank cars. In Canada all cars now manufactured have roller bearings, but there never has been any requirement of law providing for the conversion of plain bearings to roller bearings, although it would now appear that most tank cars and something just under 50 per cent of the railways' fleet (mainly box cars) are so equipped. As we learned, there were only 7 of the 69 cars on the C&O's Local 4 having plain bearings and of the cars derailed those so limited were Cars 2 and 16 (box cars) 9(Styrene) and unfortunately Car 1.

(b) Shelf Couplers.

The double shelf coupler is a device designed

to prevent the vertical displacement of the coupler on the uncoupling of a car and thus reduce the danger of puncture to the head of an adjacent car. It is now required by law on all 112 and 114 cars—see CTC Regulation, 22 January 1979. The AAR has decreed that all new cars must be so equipped and in the United States the D.O.T. has proposed that all 105 cars be likewise equipped after December 31, 1981 and all other tank cars after December 31, 1984. There is no real argument against the merit of these couplers but I understand that a double shelf coupler on a dangerous commodity car will protect it regardless of the type of coupler in an adjoining car. Consequently, for my purposes, I need not consider in this connection the state of the fleet generally. Neither Cars 1 nor 7 had double shelf couplers and for neither was it required.

(c) and (d) Head Shields and Thermal Protection. The 112 and 114 cars were not originally required to have head shields to protect the cars from puncture or thermal protection to protect against excessive heat caused by fire. Now under CTC regulation all such cars are required to be so protected (the requirement for thermal protection relates only to cars loaded with flammable gas) by June 30, 1981. The precise nature of the protection is set out in the Regulation. Car no. 8 had completed the retrofit in this regard by the time of the derailment. Cars 12

and 13 had not. In the United States there is a proposed ruling that the same should apply to 105 cars, but unlike the shelf coupler there is still debate on the subject and no formal rule has yet been made. The difference appears to be that 105's have always been insulated (to prevent the atmospheric temperature from affecting the contents) and some 105's already have some additional head thickness and it is not clear that the proposed head shield and thermal protection would provide any greater protection. There are at present tests going on in the United States aimed, in part, at determining this matter. There is no Canadian authority considering the question at the moment. There does not appear to be any formal proposal either in Canada or the United States for the retrofitting of 111 cars some of which are insulated and some not and which can and do carry flammable commodities, although not LPG's.

(e) Bottom Fittings.

Bottom fittings are for ease of loading and have never been permitted on 105's or 112's but were permitted on early 114's and have always been permitted on 111's. The difficulty with them is that they tend to sheer off in a derailment thus causing the release of their contents. Every one of the 111 cars involved in this derailment had bottom outlets and every one except Car 24 which remained upright with its rear truck still on the rails suffered damage to the bottom outlets and the release of all their contents. The AAR rule now requires bottom

outlet protection for all new cars, retrofitting of all 114 cars by December, 1984, and of 111 cars,according to the commodities carried,for periods up to 1989. There is no formal regulation either in Canada or the United States.

(f) Safety Valves.

Tank cars which carry compressed gases such as Chlorine or Propane are equipped with "safety valves" set to release into the atmosphere any excess gas when the pressure reaches a certain point. There is no retrofit programme under way or contemplated nor has anyone suggested that the valves do not satisfactorily perform the task assigned. To me, however, they do not do the job that I would have expected of them. They are designed apparently to work only in normal or relatively normal conditions. In a conflagration such as Mississauga they cannot operate to prevent a bleve and Greenwood discovered that the safety valve had not activated on Car 7 notwithstanding that the car probably ruptured from excessive heat and the ferric chloride reaction.

## 3. THE CHLORINE CAR

The full title of the car is DOT 105A500W Non-Coiled Insulated 90 ton Chlorine Car. As its name implies, it is specifically designed for the transportation

by rail of Chlorine. The DOT stands for the U.S. Department of Transportation, the 105 was successor to the class V tank car first manufactured in 1918 which was designed for the transportation of Chlorine and was insulated and of especially heavy construction. The 105 number was adopted when the Interstate Commerce Commission in the U.S. took over control of the specifications for tank cars. The DOT is in this regard the successor to the I.C.C. and corresponds to the CTC in Canada.

The A means nothing—its sole purpose is to keep the numbers apart. The number "500" denotes the pressure to which the tank has been tested on inside pressure. The tank will not rupture until the pressure gets to 2 1/2 times the 500 mark or 1250 pounds per square inch, and the safety valve is set to start to discharge at three-quarters the 500 mark or 375 pounds per square inch. The W indicates that the cars were fusion welded. As we shall see all tank cars must, by CTC regulation, be manufactured in accordance with tank car specifications of the AAR Tank Car Committee. These specifications are developed after consultation among the AAR, the Chlorine Institute and the railways and it was certainly not demonstrated that there are improvements available other than those under way or considered in the retrofit programmes, supra. The steel could be thicker but the thicker it is the heavier it will become and the load

of product will be reduced. Any increase in thickness will not apparently give proportionately greater protection.

In any event the documents of manufacture by the Hawker-Siddeley plant at Trenton, Nova Scotia, of the Chlorine car were examined in detail by Mr. E.L. Kunz, an independent expert retained by the Commission and found to conform to CTC specifications in every respect. Moreover the tank car itself was subjected to intensive tests, both non-destructive and destructive by the Ontario Research Foundation under the supervision of Mr. G.R. Wood and its reports studied on behalf of the Commission by Professor R.W. Smith of the Metallurgical Engineering Department of Queen's University, and found to have been manufactured in accordance with specifications and without defect of material. The examination of the area of the hole in the car did not disclose whether the hole came about by a puncture or by wasting of the steel in the ferric chloride reaction. There were indications of loss of metal by corrosion in the area of the hole and of a dent in the area (separate from the dent referred to supra, p. 92) caused by impact with an object. Quite possibly the hole was caused in part by a puncture and in part by the ferric chloride reaction.

4. THE BLEVED PROPANE CARS

Mr. Kunz also examined the manufacturing

documents for Cars 8, 12 and 13 and could find no significant discrepancies. As I have indicated above, Cars 12 and 13 had not been retrofitted for head shields and thermal protection, but the time had not yet run.

## 5. THE TOLUENE CAR

It was the Toluene car that caused the derailment and the most intensive examination was made of it. The car type is 111A100W1. It suffered impact damage and a minor explosion about 0930 Sunday morning which may have been caused by a build up of vapour in the tank or by thermal shock when the hot metal was sprayed with water in the ccurse of dousing a fire in Car 2.

### (a) Manufacture

First of all, Mr. Kunz examined the manufacturing documents of this car as well. It was manufactured by Hawker-Siddeley in 1967 and again he found it to be in accordance with specifications. Again the destructive and non-destructive tests were made (this time many of the parts to be tested were as noted earlier to be found distributed along the right of way) and again no significant defects were discovered.

### (b) Loading

The car was owned by North American Car Corporation and leased to Shell Canada in 1970 and used as a general purpose tank car. It had been used in 1978 in the Chicoutimi-

Chibougamau area of Quebec on Canadian National and throughout most of 1979 on the Sarnia to Toronto run via the C&O and CP Rail. For the final fateful trip it was loaded by Shell personnel at Sarnia. There appears to have been a slight error in the loading in that it was loaded to 5 inches outage—outage is the space in the tank to allow for expansion—when the required outage would have been closer to 5 1/2 inches. However this was not of consequence in the derailment. The load weight was well within the limits.

(c) The repack and the lubricator pads.

The problem with which we were most concerned in Car 1 was not in its manufacture or in its loading. It arose out of a repacking performed by C&O at Sarnia on July 30, 1979 and concerned the lubricator pads in the plain bearing journal boxes.

Although the car was owned by North American and leased to Shell, in the normal course repairs are performed by the railways as needed and billed to the owner under AAR rules. On the 29th of July, 1979, Car 1 was in the C&O yard at Sarnia, having been "shopped" for a broken hand rail. The repairs were done by C&O employees George Keyes and Frank Fichter. They have no precise memory of the matter, but it appears from the records that they took the occasion, the car being empty, to repack the journal

boxes. Under Rule 25A 1 of the Field Manual of the AAR Interchange Rules a car's plain bearing boxes must be repacked whenever they are on a repair track or empty in transportation yards and a certain time has passed. In this case the last packing stencilled on the car was "2-12-77" and the appropriate interval was 29 months. Under the rules again, on repacking new lubricator pads must be installed and again according to the records they were installed on this occasion in each of the 8 journal boxes.

The journal boxes were for this car size 6 inch by 11 inch and lubricator pads designed for those boxes are called 6 by 11 pads. They are indeed not of those dimensions but of necessity smaller to fit into the journal boxes, and can according to the make vary in the case of 6 by 11 pads from 9 3/4 inches to 10 3/4 inches in length for the whole pad including the 2 lips and from 7 1/2 inches to just under 9 inches in length for the core. The pad is composed of a cotton fabric exterior including at each end a lip which is a reinforcing tape. The cotton fabric serves to transfer oil to the surface of the journal in a wicking fashion from the bottom of the journal box. The interior of the pad (core) acts to some extent as an oil reservoir but its main function is for resiliency to maintain pressure or contact between the pad and the journal surface.

We must now go back to the debris of Car 1 as found on the ground near Mavis Road. One 6 1/2 inch by 12 inch lubricator believed to be from journal box L1 was found at Burnhamthorpe Road. Two 6 1/2 inch by 12 inch lubricators were found in place in the L3 and L4 journal boxes, and two 6 inch by 11 inch lubricators were found in place in the R3 and R4 journal boxes.

We return to the Sarnia yard. Lubricators must be soaked in oil before installation and for the purpose the C&O kept 3 bins, A, B and C. In A bin were stored the 6 by 11 lubricators, in B the 5 1/2 by 10 lubricators, and in C the 5 by 9 lubricators. Unfortunately there were only 3 bins, but there were more than 3 sizes of lubricators, one being 6 1/2 by 12 inches, which was not in great demand but was used occasionally. The dates of manufacture of the 12 inch lubricators found corresponded with times at which lubricators were delivered to the C&O and although it is possible that new lubricators could have been installed (trackside) by some other carrier between July and November, it is probable that Keyes and Fichter mistakenly installed 12 inch lubricators in the L1, L3 and L4 journal boxes. The burning question however is what they installed in the R1 box. It might have been a 12 inch as in L1, L3 and L4, or it might just as well have been an 11 inch as in the R3 and R4. I simply cannot say and I don't see how anyone

will ever know. The pad itself which would have been our proof disappeared in flame sometime before the train reached Burnhamthorpe Road.

Does it matter? Again I don't know the answer. We had the benefit of the evidence of two expert and impressive witnesses who gave diametrically opposed views. Mr. Henry Wintringham, the general manager of Southland Manufacturing Company of Norfolk, Virginia, who developed the Southland lubricator in the United States and the Eureka in Canada, said that in his view size is important and a pad too large is apt to be cut by the collar (the ridge at the extremity) of the journal which might cause pieces of the pad to be drawn up onto the journal and create an area of lack of lubrication and eventually a hot box. He examined the remains of what was believed to be the L1 pad and thought there were signs of collar cutting.

Mr. James Hennessy, the President of Hennessy Products Corporation of Chambersburg, Pennsylvania, who developed the Oilwell and Pluswell pads, was much less concerned about an "over-sized" pad. He said it was most unlikely for a pad to be cut by a normal smooth collar even if pad and collar did come in contact. In any event he said the only result would be lint which would cause no problem. He could see no signs of collar cutting in the remains of the L1 pad.

One would assume that it is better in putting a lubricator into a journal to put in the size of the lubricator for that size of journal. The AAR permits the use of 5 by 9 inch lubricators in 4 1/2 by 8 inch journal boxes but is silent on any other substitution. It seems that the AAR would not consider the installation of "wrong" size lubricators to be "wrong repair" justifying a debit charge against the repairer. It also appears from a survey conducted by the C&O that the installation of "wrong" size pads while not common is not unknown and such pads continue to lubricate satisfactorily for years and indeed the pads in L3 and L4 on Car 1 were apparently lubricating satisfactorily at the time of the derailment.

The AAR in its quarterly hot box reports list as one of the causes "lubricator-wrong size" but it has very small incidence indeed.

In summary I cannot say that a 12 inch lubricator pad was installed in the R1 journal box of Car 1 on July 30, 1979. Nor can I say that if it were it would have or even might have caused or contributed to the hot box. What I can say, I think, is this. Until it is established conclusively that a "wrong" size pad will do no harm, it is incumbent on the C&O to maintain a system of separation of pads so that such a pad is unlikely to be installed.

# VII. GOVERNMENT OF THE RAILWAYS

## 1. THE CANADIAN TRANSPORT COMMISSION

### (a) HISTORY

The history of the railway regulatory bodies pre-dates Confederation. The Board of Railway Commissioners was established in 1851 initially to supervise construction of a line through Upper and Lower Canada and connecting with Nova Scotia and New Brunswick, but it was shortly thereafter expanded to acquire powers of supervision including the prevention of accidents.

The first Railway Act was enacted almost immediately after Confederation and the regulation of railways was by it consigned to the Railway Committee of the Privy Council and there it remained until 1903 when the Board of Railway Commissioners was resurrected with powers on pricing, construction, operation and safety.

The powers and duties of the Board after 1903 expanded to have jurisdiction over telegraph and telephones and culminated in the enactment of the Transport Act of 1938 with the inclusion (temporarily) under its jurisdiction of air and water transport; it was renamed the Board of Transport Commissioners.

There were several revisions to the Board's jurisdiction in the interim but the next major development was the enactment of the National Transportation Act of

1967 which set up a single authority to regulate all methods of transportation and named that authority the Canadian Transport Commission. Within this Commission were established 5 modal committees for air, pipeline, motor vehicle, water and railway transport. The latter was (and is) called the Railway Transport Committee. Under the Act the committees have power to exercise all the powers of the Commission except regulation-making and even there, in practice, the committees perform the initiating function.

## (b) JURISDICTION OF THE CTC AND RTC

The jurisdiction of the Commission and its committee in the government supervision and investigation of the railways is almost limitless. It has control over the operation, the fares, the construction and abandonment of lines, the construction and maintenance of stations and other facilities. Our main concern is with operation and here the important statutory provisions appear to be Sections 227, 228 and 296(1) of the Railway Act and Section 3 of the National Transportation Act. These sections are as follows:

Railway Act:

227. (1) The Commission may make orders and regulations

(a) limiting the rate of speed at which railway trains and locomotives may be run in any city, town or village, or in any class of cities, towns or villages; and the Commission may, if it thinks fit, limit certain rates of speed within certain described portions of any city, town or village, and different rates of speed in other portions thereof;

(b) with respect to the use of a whistle within any city, town or village, or any portion thereof;

(c) with respect to the method and means of passing from one car to another, either inside or overhead, and for the safety of railway employees while passing from one car to another;

(d) for the coupling of cars;

(e) requiring proper shelter to be provided for all railway employees when on duty;

(f) with respect to the use on any engine of nettings, screens, gates and other devices, and the use on any engine or car of any appliances and precautions, that may be deemed by the Commission necessary and most suitable to prevent, as far as possible, fires from being started or occurring upon, along, or near the right-of-way of the railway;

(g) with respect to the rolling stock, apparatus, cattle-guards, appliances, signals, methods, devices, structures and works, including light, heat and power lines or wires to be used upon the railway, so as to provide means for the due protection of property, the employees of the company, and the public and all persons travelling on Her Majesty's service;

(h) with respect to the length of sections required to be kept in repair by employees of the company, and with respect to the number of employees required for each section, so as to ensure safety to the public and to employees;

(i) designating the number of men to be employed upon trains, with a view to the safety of the public and of employees;

(j) limiting or regulating the hours of duty of any employees or class or classes of employees, with a view to the safety of the public and of employees;

(k) providing that a specified kind of fuel or a specified kind of power or method or means of propulsion shall be used on any or all locomotives and trains in any district; and

(l) generally providing for the protection of property, and the protection, safety, accommodation and comfort of the public, and of the employees of the company, in the running and operating of trains and the speed thereof, or the use of engines, by the company on or in connection with the railway.

(2) Any orders or regulations under this section may be made applicable during or after the construction of the railway, or during such time, and in such manner, as the Commission deems proper.

228. The Commission shall endeavour to provide for uniformity in the construction of rolling stock to be used upon the railway, and for uniformity of rules for the operation and running of trains.

296.(1) The company shall not carry any goods of an explosive or dangerous nature except in conformity with the regulations made by the Commission in that behalf.

National Transportation Act:

3. It is hereby declared that an economic, efficient and adequate transportation system making the best use of all available modes of transportation at the lowest total cost is essential to protect the interests of the users of transportation and to maintain the economic well-being and growth of Canada, and that these objectives are most likely to be achieved when all modes of transport are able to compete under conditions ensuring that having due regard to national policy and to legal and constitutional requirements

> (a) regulation of all modes of transport will not be of such a nature as to restrict the ability of any mode of transport to compete freely with any other modes of transport;
>
> (b) each mode of transport, so far as practicable, bears a fair proportion of the real costs of the resources, facilities and services provided that mode of transport at public expense;
>
> (c) each mode of transport, so far as practicable, receives compensation for the resources, facilities and services that it is required to provide as an imposed public duty; and
>
> (d) each mode of transport, so far as practicable, carries traffic to or from any point in Canada under tolls and conditions that do not constitute
>
> (i) an unfair disadvantage in respect of any such traffic beyond that disadvantage inherent in the location or volume of the traffic, the scale of operation connected therewith or the type of traffic or service involved, or
>
> (ii) an undue obstacle to the interchange of commodities between points in Canada or unreasonable discouragement to the development of primary or secondary industries or to export trade in or from any region of Canada or to the movement of commodities through Canadian ports;
>
> and this Act is enacted in accordance with and for the attainment of so much of these objectives as fall within the purview of subject-matters under the jurisdiction of Parliament relating to transportation.

I think the first thing we should notice is that while the CTC has the power (and the duty) to guard the public's safety, it is also under an obligation to consider the economic realities of the situation and the competitive

positions of the railways vis-a-vis other modes of transport. I am not at all sure that my concern extends beyond safety, but I mention the conflicting concerns of the CTC so that it will be understood that when I describe their activities (or lack of activities) in certain areas, I understand their problem, or if you will, their dilemma.

It was, of course under section 228 of the Railway Act that the Uniform Code of Operating Rules was issued. The control of the carriage of dangerous commodities is much less direct. It will be seen that the Railway Act, s. 227(1)(l) provides for "...safety...in the running and operating of trains" and this would not cover the regulation of shippers and manufacturers, but s. 296 of the Act comes partly to the rescue. It is pursuant to this section, with the additional help of the National Transportation Act, s. 46(1)(a) giving the CTC power to regulate with respect to any matter that is sanctioned, required to be done, or prohibited by the Railway Act, that the regulations for the transportation of dangerous commodities by rail (the Red Book) are made.

(c) THE RED BOOK

The Red Book is an outgrowth of the regulations

first published by the Bureau of Explosives of the Association of American Railroads. These regulations were adopted and made law in 1911 in the United States by the Interstate Commerce Commission and as we have seen that latter organization has given way in this field to the Department of Transportation. The present regulations are now published in the United States as Title 49 of the United States Code of Federal Regulations.

The Board of Railway Commissioners issued its first regulations in 1909. The Red Book in its present consolidation is known formally as CTC General Order No. 1974-1-Rail and was, as one might suspect, published in 1974.

There are some distinctions between the Red Book and Title 49, e.g. the Emergency Response Forms referred to earlier which are required in Canada but not in the United States, but generally speaking the regulations are identical. This has its advantage because there is a tremendous amount of international rail traffic and it enables both countries to have an international acceptance clause—see Red Book 73.8 and 74.505. The difficulty, if it is one, is that it follows almost inevitably that the initiative in the field lies with the AAR. While Canadian railways and indeed Canadian manufacturers and shippers are members or associate members of that organization, there is no contribution to its deliberations on behalf of the Canadian public.

The Red Book--which is exceedingly difficult to comprehend--is divided into parts. In one part is a list of dangerous commodities, in others there are regulations applying to shippers, carriers and tank car manufacturers. The scheme is that the tank car will be manufactured according to the specifications and will be shipped, loaded, marked and labelled according to the regulations in that regard. If they are not, then the carrier must not accept them (Railway Act, s. 296). After acceptance by the carrier, the dangerous commodities will be carried in accordance with the Red Book's regulations for that carriage.

(d) THE INVESTIGATORY PROCESS

One of the great tools in control of the operation of railways is the investigation of accidents. Section 225 of the Railway Act requires all accidents involving injury or more than trivial property damage to be reported to the CTC. There is a wide discretion to the Commission as to its reaction. It may do essentially nothing relying upon the Railway's report. It may cause an investigation to be conducted by one of its officers or it may hold a full scale inquiry. I am going to deal with some of these investigations but before doing so, it is

desirable to consider and emphasize three matters of vital importance to this Inquiry. They are roller bearings, hot box detectors and marshalling.

(i) ROLLER BEARINGS

We must never forget that this accident was caused (I am not here referring to the contributing factors) by a hot box in a plain or friction bearing journal. As I have pointed out, roller bearings have been known since the early fifties and have been compulsory (by AAR rule) on all new tank cars since 1967. While a roller bearing journal failure is certainly not unknown and is harder to detect visually, it is vastly less likely to occur than is a plain bearing journal failure.

(ii) HOT BOX DETECTORS

Hot box detectors are a device designed to warn of the existence of a hot box before there is a burn-off and derailment. The general principle is the detection and recording of extraordinary heat and they are placed at locations where no heat will be generated by other factors, e.g. brakes on grades or switches, etc. Some of the hot box detectors, for example, those now used by Canadian National,

are recorded in a central location and some as now used by CP Rail are recorded on a screen at trackside and read by the crew. There are some train-mounted hot box detectors that we have heard about but they don't yet seem to have found favour.

Those hot box detectors that have been installed by the railways appear to have been effective. The only problem is that there does not seem to be unanimity of opinion on their spacing. In the United States, some railroads have set them apart by only 20 miles. In Canada the CN seems to think 30 miles is enough. If the hot box at Mississauga started at or after Guelph Junction it would seem that a 20 mile interval is safer.

(iii) MARSHALLING

The marshalling of a train is the arranging in the yard of cars in their proper order. Often cars must be placed in a certain order for ease of setting-off or delivery, but that is not our problem. Our problems relate to the Red Book marshalling requirements when dangerous commodities are being carried.

The Red Book requires first that dangerous commodity cars must be placarded, that there be controls over the switching of such cars and that many of the more dangerous commodity cars be placed in a special order on the train. The object is to keep particularly dangerous cars away from the head or tail end and to keep certain dangerous commodity cars away from others. Prior to Mississauga however there was nothing to prohibit a Chlorine car being marshalled next to a Propane car or any other LPG tank car.

(e) THE GENERAL SAFETY INQUIRY OF 1971

During the 1960s, the RTC's figures disclosed an alarming increase in the number of derailments. There also were 3 serious accidents in 1970 in Ontario which caused much public concern and resulted in public inquiries by the RTC. The first was a derailment at Cobourg of 25 cars of CP Rail caused by a roller bearing failure, the second was a derailment of 14 cars of CN at Port Hope caused by a plain bearing failure, and the third was a collision between a CN passenger train and a track motor car near Brockville.

As a result of the worsening situation and the evidence adduced at the public hearings, it was decided to hold a General Safety Inquiry with the following terms of reference:

1. Rule instruction and examination procedures.
2. Supervision of train operations.
3. Track motor car operation where there is centralized traffic control and where there is not centralized traffic control.
4. Use of radio as a means of communication and its maintenance.
5. Procedures followed by railway companies when accidents occur including accidents involving dangerous commodities.
6. Instructions given to train crews and wrecking crews respecting the transportation and handling of dangerous commodities by rail.
7. Maintenance and inspection of roller bearing and solid bearing rolling stock (including locomotives) and the structure and design of cars and equipment.
8. Location of maintenance and inspection staff.
9. Rolling stock inspection procedure (including locomotives) at major terminals, at intermediate points and while en route.
10. Standards and procedures of maintenance and operation of all types of railway signalling installations.
11. Standards and procedures of maintenance of track and structures.
12. Allocation of staff, materials and equipment for adequate inspection and maintenance of track, structures and signals.
13. Need for revision of railway companies' own rules and instructions to their employees.
14. Extent of research and development by railway companies respecting safety in all aspects of railway transportation.
15. Revision of C.T.C. General Orders, staff and safety function.

I set out these terms of reference in full because of their remarkable similarity to the problems that affected us in this Inquiry.

The General Safety Inquiry occupied 36 days; evidence was presented on hot box detectors, journal bearings and dangerous commodities. During the hearing, there appear to have been 4 train accidents involving dangerous commodities which particularly alarmed the Committee. As it expressed the problem in its initial report:

> " These accidents raise certain urgent and critical questions for the Inquiry. With dangerous commodities creating such hazards was the regulatory authority in Canada being confronted with a new dimension in destructiveness and danger to life and limb? The answer to this question certainly appears to be affirmative. If so, what were the reasons for this other than the obvious factor that modern industrial technology is producing larger quantities of dangerous materials having a greater destructive potential per ton or per car than ever before? Is for example new railway technology increasing the hazards? Are railway practices and rules for dangerous commodities many of which date back 20 or 30 years adequate to meet the increased hazards? Are these possibly now inadequate rules at least being properly applied by railway personnel? Is there sufficient enforcement? How much research into the causes of and the prevention of such destruction is being done?
>
> Throughout the Inquiry these questions and many others like them kept recurring. However as the Inquiry progressed the panel was increasingly of the view that more detailed information was required than a public hearing could provide. It was also felt that action needed to be taken urgently and that this work should commence as soon as the public hearings ended.

> It was proposed that a Task Force on the Carriage by Rail of Dangerous Commodities be created. This was immediately and enthusiastically seconded by the railways. The proposal was accepted and the committee addressed itself to its implementation.
>
> The Task Force consists of the Committee, the CNR, CP Rail and the Canadian Railway Labour Association. Its terms of reference are simple: to review the hazards attendant on the carriage of dangerous commodities by rail and to recommend to the committee such measures as will achieve the highest level of safety compatible with economy of operation and expeditious movement of goods."

This Task Force was duly established together with a consulting pool with representatives from industry and the tank car lessors, shippers and others concerned. The Task Force was divided into groups which reported to the Task Force which in turn reported to the Committee. It expired in 1975 but its work seems to have been taken over by the Dangerous Commodities Technical Committee and the Railway Safety Advisory Committee or by the combination of both.

The important thing to me, however, is not the organization of the committees studying the questions but what was studied. In this connection the initial report of 1973 was silent on roller bearings, hot box detectors and marshalling, although all 3 subjects were the object of much testimony. The Inquiry promised future reports and one such report was forthcoming entitled the Third Report of the General Safety Inquiry, released in December, 1973, and

contained a recommendation with respect to hot box detectors as follows:

> " The Railway Transport Committee and its staff intensify their study of derailments on account of burnt-off journals in all railways coming under the jurisdiction of the Canadian Transport Commission so that the Committee can make a better evaluation and determination of the most effective and efficient methods of reducing the number of such derailments and thus improve the safety of operation of trains."

It is a well intentioned recommendation but in my respectful view absolutely meaningless.

(f) INITIATIVES OF THE CTC

There have been other initiatives of the CTC since the General Safety Inquiry, notably a vigorous improvement in track standards and maintenance undertaken by the railways after a not-too-veiled threat contained in the Third Report to reduce the weight of car loads if something was not done about the state of the tracks. In 1974 there were a number of amendments to the Red Book including the provisions for the Emergency Response Form. The Commission apparently encouraged the railways in providing refresher courses for their employees in the Red Book and in preparing emergency response plans for their dispatchers.

The Task Force ran a seminar for shippers and firemen and the CTC is currently involved in preparing air brake regulations and standards of visual acuity requirements for enginemen.

(g) OTHER INVESTIGATIONS

The CTC has continued its investigatory work most notably an inquiry into the derailment of a coal train in British Columbia in November, 1977, which contained a recommendation for the installation of an event recorder in all locomotives, which I am informed is about to be implemented. The CTC has also very recently investigated a Canadian National derailment in Manitoba (The McGregor Derailment) and in its recommendations has called upon CN to submit a report containing plans for improvement of its safety procedures.

(h) MONITORING OF TRAIN OPERATIONS

One of the most important safety programmes devised by the CTC is its monitoring of train operations to determine the state of compliance with regulations and indeed the state of the railways generally. This programme has only recently been instigated but it has already elicited some interesting statistics. For example, some 27 per cent

of all cars inspected have been found to be defective in some particular. Many of these defects may not be dangerous and many may have been discovered by CTC inspectors just before they would have been discovered by railway carmen. Nevertheless the figure seems disproportionately large and one figure, namely 34 per cent of cars leaving repair shops having defects seems positively alarming.

(i) THE SHOW CAUSE SUMMONS AND THE MARSHALLING ORDER

After the Mississauga incident (at which as I have stated there were in attendance at one time or another, the President, the Chairman of the Rail Safety Advisory Committee, and many officers) the CTC issued a "show cause summons" directed to CN, CP and the Railway Association of Canada with respect to a proposed order requiring 6 cars with roller bearings between the locomotive and the dangerous commodity cars and failing that a maximum speed of 25 miles per hour. It was dissuaded however from implementing the order by the protests of the railways that it would cause additional switching and that it would adversely affect parties not notified of the proposal, e.g. shippers and owners of tank cars. Instead there was issued a marshalling order to the effect that shipments of Chlorine, anhydrous ammonia and sulphur dioxide be separated by 5 non-placarded cars from shipments of cars containing flammable compressed gases. This may be a sensible

order, but I have already noted (ante, p. 88) that it was perhaps the proximity of the Chlorine car to the bleved Propane cars that carried the Chlorine more or less harmlessly into the air and in any event the order could be only fairly effective when one appreciates that a Propane car is capable of bleveing 2222 feet.

(j) CTC's INACTION

For all these initiatives and for its work in other fields, the CTC is entitled to commendation. At the same time we must appreciate that in the matters with which we are concerned almost all of which were in the terms of reference of the General Safety Inquiry, its decision - perhaps deliberately made - has been to do nothing.

On hot box detectors at the General Safety Inquiry the CN reported themselves in favour and undertaking a vast programme of installation. CP Rail which was testing the machines was very dubious of their merits and was afraid that if the detectors were in place the crew might become too relaxed in their running inspections. The CTC took no action. CP Rail has since become a convert and has very recently installed hot box detectors on the London Division. At the time of Mississauga, however, there was only one on the Windsor Subdivision and none on the Galt Subdivision.

On roller bearings the Inquiry received a report from both railways as to their programmes and was apparently content. In any event no order was made and the railways fleets still have more than one-half of all cars equipped with plain bearings.

On speed the CTC has the authority to regulate but virtually does none. The railways have authority in the absence of CTC orders to set speed limits and have taken full advantage of it.

(k) THE QUESTION OF FUNDING

The reason for this inactivity, if such it can be called, is twofold. First there is a lack of money and manpower. In this connection a submission has, I understand, gone into Treasury Board seeking provision for more salaries to expand the accident investigation, inspection, planning and standards development programmes including the engaging of specially qualified officers to go into shippers and manufacturers' plants and railway yards throughout Canada to ensure compliance with Red Book regulations. I have no knowledge of the priorities and I do not wish to intrude upon Treasury Board decisions. But surely at the very least the CTC should have the funds to find answers not dependent on information or advice supplied

by the railways. The railways are answerable to their shareholders; the CTC is answerable to the public.

(1) THE CONSIDERATION OF ECONOMICS AND THE BURDEN OF PROOF

The other reason is philosophical. It was very clear from the evidence of Mr. David Jones, the former chairman, and Mr. John Gray, the present chairman of the RTC, that there is an ingrained reluctance to take any action involving expenditure or loss to the railways without a complete investigation of the amount of that expenditure or loss and an assurance that the benefit to be gained will fully compensate for that loss.

It is not a philosophy that I fully share. I cannot understand how the CTC could accept the railways' own programmes for conversion to roller bearings and for installation of hot box detectors when both are universally accepted as desirable improvements and when at least in the case of hot box detectors the programmes were quite different. I cannot understand how the Commission could leave to the railways the regulation of the speed and length of trains. A long, fast train is a profitable one; it is not necessarily a safe one. I accept, of course, that in the course of natural justice one does not normally

make an order affecting another's rights or pocket book without giving that other a chance to be heard. But there may come a time, where the safety of the citizen is concerned, when the onus shifts. In such case the burden of proof may (perhaps should) fall upon him who creates the risk.

## 2. TRANSPORTATION OF DANGEROUS GOODS ACT

This Act was passed by the Federal Parliament in July of 1980 and was proclaimed on the 1st November, 1980. Its stated purpose is to promote public safety in the transportation of dangerous goods and so a consideration of that statute is central to the solution of the problems that arose in Mississauga.

I should just pause to mention here that the authors of the statute preferred "goods" to "commodities" while the authors of the Red Book clearly had the opposite preference. No doubt "commodities" came from U.S. practice, where indeed the object of the legislation is now often referred to as "hazardous materials". For what it's worth, I express a personal uninformed opinion in favour of "goods". I also prefer "dangerous" to "hazardous". It seems more comprehensive and less affected.

The Act contains provisions to classify all dangerous goods into nine classes, to create offences and penalties for breach of the Act, to provide for inspectors to enforce the Act, to impose duties to report dangerous occurrences and most important to enable the Governor-in-Council to make regulations respecting all aspects of the transportation of dangerous goods.

Two rather important provisions are s. 17 which empowers an inspector to "request" any other person whom he deems to be competent to take emergency measures (s.14(5) appears to make failure to comply with a reasonable request an offence), and s. 26 which authorizes the Minister either alone or in cooperation with others to engage in technical research.

The regulations under the Act have been drafted but to date the concern is more with safety standards than with safety procedures. Also as I understand it (almost all our information on the proposed course came from Mr. Duncan Ellison, the very dedicated Director of the Transportation of Dangerous Goods Branch, Transport Canada) it is contemplated that the CTC will initiate the drafting of the rules with respect to dangerous goods. Those that have general application to railway operations may continue to be promulgated under the Railway Act. Those that relate only to the carriage of dangerous goods will be promulgated under the new Act.

The draftsmen of the Act, as I have said, fully recognize the constitutional problems and provision is made in the Act for federal-provincial agreements to implement the Act's intention. Mr. Ellison recognizes that emergency response is generally speaking a provincial matter but it is his intention that the federal inspectors will provide guidance where required. Of particular importance is the intention to expand the present federal response centre known as CANUTEC which is available on a 24-hour basis so that it is equipped to provide that guidance.

The enactment of the Transportation of Dangerous Goods Act is obviously a great advance in the field, but there are still drawbacks to overcome. There is still no compulsory provision for an adequate private response. The meat of the Act is in the regulations and these regulations are not yet promulgated. No doubt the responsible officials are now working on it and perhaps some of the recommendations in this report will help in the task.

The Act can only work if the inspectors under it are capable of doing the job assigned. It is contemplated that there will be different kinds of inspectors for different tasks, some with great proficiency in the handling of dangerous goods, some with less, some under permanent employment, some only coincidentally with their regular

employment which might be in the police or fire departments of the nation. Their training is essential and provision is made in s. 21 to make regulations prescribing their training and qualifications.

The new Act may have other imperfections not now apparent, but it has provided us with the machinery we need to establish within the limits of our constitution a workable system for the transportation of dangerous goods.

## 3. THE AMERICAN EXPERIENCE

### (a) THE ASSOCIATION OF AMERICAN RAILROADS

We have already heard about the Association of American Railroads and their work, particularly the work of their Tank Car Committee throughout this century in the development of the modern tank car.

### (b) THE BUREAU OF EXPLOSIVES

The Bureau of Explosives is a constituent part of the AAR designed (to quote from its introductory pamphlet) "to promote the safe handling and transportation of hazardous materials and to serve as a central agency for collection, analysis and dissemination of information

on these materials and to provide emergency assistance to its members."

On behalf of its members who are railways, manufacturers and shippers, the Bureau carries on regular inspections for compliance with the regulations and gives technical assistance. For our purposes, however, its important services are (1) as an advisor on tank car specifications, and (2) to assist the railways on a dangerous goods spill. The Red Book provides innumerable references to Bureau of Explosives standards and requirements of submissions not only to the CTC but to the Bureau of Explosives as well. Indeed the Red Book provides that the plants of shippers shall be open to representatives of the Bureau of Explosives, a provision of dubious constitutional validity but one against which the shippers are unlikely to rebel. To a large extent the CTC has delegated the regulation of the control of dangerous goods to the Bureau.

To a large extent also the railways are dependent on the Bureau for assistance in a dangerous goods accident. Emergency aid is available on a 24-hour basis, and the Bureau has published a comprehensive booklet entitled "Emergency Handling of Hazardous Materials" which is a constant companion of some railway officers and crews.

The CP Rail flow chart requires the Chief Train Dispatcher to call the Bureau of Explosives inspector even before notifying his own superintendent and on the morning of November 11, 1979, Kent of London did in fact notify the appropriate inspector, one Alvin Deckert, about 0100 hours. Deckert, who was in Montreal at the time, arrived at the scene about 10 a.m. and remained on or near the site the rest of the week. He gave as much assistance as he could but, of course, the real expertise was provided by Johnson of Superior Propane and the Chlorep team of Dow.

(c) THE NATIONAL TRANSPORTATION SAFETY BOARD

The control of railways in the United States is under the Department of Transportation and its component the Federal Railway Administration. I have, of course, made no study of its operations generally even so far as those operations relate to safety. Certainly I do not intend to make invidious comparison between the governing bodies of the two nations. In fact the evidence would appear to demand an inference very favourable to Canada. A study for the U.S. government indicates that our safety record is better than theirs and figures supplied by CP Rail indicate that that company has had rather consistently over the past several years the best accident rate among major railroads in North America.

The U.S. government emanation that I do wish to refer to is the National Transportation Safety Board which has published reports on all major rail accidents and has, from time to time, undertaken special studies and made specific recommendations. I cannot, of course, accept the facts set out in the reports nor slavishly follow the recommendations. But for an appreciation of the problems the reports are invaluable.

(i) CRESCENT CITY

Of the many reports of specific accidents, I make mention of only the derailment at Crescent City, Illinois, on the 21st June, 1970, and I mention it because of the many similarities in that derailment to that at Mississauga. The Crescent City derailment involved 15 cars of a 109 car train, 9 of which derailed cars were loaded with LPGs. One of these cars was punctured and the leaking propane ignited, resulting in a series of explosions, many injuries and much damage.

The Board found the derailment caused by a hot box and that the heat generated from the fire from the initial puncture caused the other cars to rupture and explode. The safety valves were useless to prevent the

explosion although the firemen on duty had mistakenly believed that so long as the valves were working the tanks would not rupture.

The fire of the hot box had been observed by a witness some 7 miles back from the derailment, but during that stretch there were no curves and the Board attached no blame to the crew for failing to inspect and discover the hot box which was on the 20th car from the head end of the train. The Board noted that while hot boxes were becoming less frequent, their detection before burn-off was not improving. It attributed this to a reduction in smoke from a burning hot box resulting from the new and improved lubricator pads, to fewer employees along the tracks to note the hot box and warn the crew, and to complacency among crews.

The Board further noted the difficulty of the firemen in locating the dangerous commodities and deprecated the close proximity to each other of LPG cars, the speed of the train, and the lack of insulation and centre sills of the tank cars.

The Board recommended inter alia acceleration of installation of hot box detectors, an expansion of education for railway and firefighting personnel, research

in tank car design, and strict enforcement of running, standing and walking inspections.

Of the many general reports of the National Safety Transportation Board, I would mention only 3.

(ii) SAFETY EFFECTIVENESS EVALUATION

First and perhaps most important is a report dated June 23, 1978 on hearings held by the Board in April of 1978 on "Safety Effectiveness Evaluations". The Board noted that tank cars had got bigger but not safer. It noted also that the design of 112A and 114A series cars (which were much bigger than the 105s) was approved without consideration at least by any federal agency of safety, that although the Department of Transportation had issued regulations requiring retrofit of the cars for shelf couplers, head shields and thermal protection, the time limit for compliance was unnecessarily long and there was no apparent sense of urgency in the industry to comply earlier. The cost to the industry of the retrofit was in the opinion of the Board easily overcome by the savings in larger tank cars. There was inadequate provision for emergency response and the communication of post-accident lessons was ineffective.

The Board recommended immediate installation of head shields and double shelf couplers, installation of thermal protection by December 31, 1980, and made many recommendations for improved emergency response. It also recommended establishing priorities for track upgrading and consideration of a "National Rail Hazardous Material Routing System" with a view to the least population exposure.

(iii) TANK CAR SAFEGUARDS

In another special report dated March 8, 1980 on the Accident Performance of Tank Car Safeguards following a derailment of a chemical train in Texas, the Board recommended that the requirement of double shelf couplers be extended to all tank cars transporting hazardous materials, that the requirement for head shields and thermal protection be extended to 105 cars and that it be considered whether it should also be extended to 111 cars when carrying toxic materials. It further recommended the protection of top fittings and bottom outlets and that tests be conducted to determine if marshalling could reduce the severity of collisions.

(iv) NON-COMPLIANCE WITH HAZARDOUS MATERIALS SAFETY REGULATIONS

Finally in a report dated August 3, 1979 the

Board investigated the "Non-compliance with Hazardous Material Safety Regulations" particularly in the area of packaging, labelling, record-keeping and quantity limits and found that the main reason for non-compliance was non-awareness of the regulations induced largely by the complexity and incomprehensibility of those regulations as published.

# VIII. THE LESSONS OF MISSISSAUGA

## 1. ON THE RUNNING OF TRAINS

I have no quarrel with the general proposition that trains should be run by the railways. The railways have the knowledge, the experience and the interest to ensure that trains are run efficiently, and it appears to be axiomatic at least in the minds of railway men that a safe railway is an efficient railway. I have attached as Appendix 5 a reproduction of Exhibits 360 and 361 which are figures put together by the CTC specifically for this Inquiry. From these figures we see that there are in Canadian railways approximately one derailment per day and of those from one-sixth to one-ninth are attributable to journal failure. These are statistics that we probably could live with if the only questions were the efficient running of the railway and the safety of the persons running it. The railways would (and do) in the interest of efficiency take measures to reduce or control the number of derailments and they, together with the unions, are assuredly going to do all they can to reduce the injuries to crews. But a new element, a new concern of safety, is added when the railways transport dangerous goods. We have seen how Car 13 bleved 2222 feet and the scientific evidence is that it can bleve considerably farther. We have seen that there is danger to life

within several miles of a disabled Chlorine car. There was a great deal of dispute about the danger posed by this particular Chlorine car; there could be no dispute of the danger from a disabled Chlorine car from which all of the contents escaped. At Newton, Alabama, all of the Chlorine did escape and at Mississauga most of the Chlorine escaped in the first few minutes with little or no adverse effects perhaps because of the drawing-up effect of the explosion and the fire, but in Youngstown, Florida, much less was lost in the early minutes with devastating effect. The public has an interest in the running of trains when those trains are carrying dangerous goods and it is to that interest that I now address myself.

(a) THE CAUSE OF THE HOT BOX

It would certainly help us to determine the imperative remedies if we know what caused this particular hot box. We know, however, only that the cause could have been one of many. According to the AAR Quarterly Report (referred to ante p. 106) and according to certain posters displayed by CP Rail in car department areas, the main causes more or less in descending order of frequency are cut or pitted journals, dry journal boxes, displaced or damaged wedges

or bearings, water, ice or snow in the journal box and damaged lubricator pads. Any of these could have been the cause, but most of them require an inadequate inspection at Sarnia or Chatham or both. The bearing or wedge could have been displaced in the shunting or switching operations beginning at Chatham after the mechanical inspections were completed. Mr. Wright noted that the L1 brass found at the scene had a broken collar. He thought it to be an old break and he suspected that the R1 brass would be in similar condition because of the lateral movement of the journal, thus increasing that lateral movement. Neither broken collar would be discoverable on a carman's inspection. As the train went through the spring switch at Guelph Junction (so the theory went) there was an excessive side slap which disturbed the lubrication on the R1 journal sufficiently to create a hot box. CP Rail's theory is, as pointed out above, that the installation of the wrong sized lubricator pad caused some of the pad material to come between the brass and the journal and destroy the lubrication. Either theory and many others are possible. None, in my opinion, is demonstrated.

(b) THE STATE OF THE HOT BOX FROM WINSTON CHURCHILL BLVD. TO THE EAST.

Mr. Wright's theory involved the following progression in the development of the hot box -

(a) after leaving Guelph Junction there would be a small amount of smoke gradually increasing as the system got hotter;

(b) the babbit—the inner portion of the brass which is made of lead and rests upon the lubricated journal—would melt at 450 to 500° F. and the journal would start up into the brass;

(c) when the temperature reached 800° F. the combustible material would light up, that is enflame, and that would be coming out of Milton. At first there would be intermittent flame but by Winston Churchill Blvd. the seals in the journal box would have burnt out allowing more oxygen in and producing a steady flame.

CP Rail's theory is of a quick burn off, one that started many miles past Guelph Junction and was only in the intermittent flame stage at Derry Road. As I indicated earlier (p.59) I don't intend to determine which theory is correct on the basis of expert conjecture. I do, however, on the evidence of Mr. and Mrs. Houston find that there was smoke coming from the undercarriage of a tank car on the train and I conclude that that smoke was not brake smoke but rather was smoke emanating from the R1 journal of the 33rd car of that train and was the first sign visible to any witness of the hot box that caused the derailment. I also accept the evidence of Mr. Anthony that there was

nothing visible on the north side just west of Trafalgar Road and of Mr. and Mrs. McGregor (this evidence was hardly questioned) that there was a steady flame before, at and past the crossing at Derry Road. The distance between Winston Churchill Blvd. and Derry Road is 1.2 miles. At 50 miles per hour that train would traverse that distance in less than a minute and a half. As I have said I am not required to make findings of fact, but I am required to assess the adequacy of the existing practices of the railways and in assessing the adequacy of the running inspection of this train at this place, I think it is a reasonable if not an inescapable inference that there was some flame, perhaps not steady, to be seen at Winston Churchill Blvd. by those who could see and were looking. On the evidence of the McGregors at Derry Road, Mr. Siu at Eglinton and the other witnesses to the east, I conclude that there was fire or sparks or both emanating from Car 1 from Derry Road to the derailment. I do not accept the evidence of Miss Carter that she saw the undercarriage of the train and Miss Bota, Mr. Galvan and Mr. Correa make no pretence to having seen the whole train.

(c) THE INSPECTION PROCESS

As we have seen, there are many types of inspection. I cannot point to any appropriate rule but in practice there seem to be these distinctions, at least

in the area and on the railways with which we are concerned.

(a) There is a mechanical inspection when the train is initially marshalled, e.g. Windsor for Train 84 and Sarnia for Local 4. This involves for our purposes the lifting of the plain bearing journal box lid and the No. 1 brake test, i.e., testing the brakes on each car as well as ensuring that the air brake system generally works.

(b) There is an interchange inspection when a car passes from one railway to another, e.g. at the Chatham CP yard. This again for our purposes involves the lifting of the lid of the plain bearing journal box but only the No. 2 brake test, i.e. inspection of the brakes on the cars lifted and the caboose and ensuring that the air is passed from the engine to the caboose.

(c) There is a walk-by or pull-by inspection made by carmen at intermediate terminals when the crew is changed, e.g. at London for Train 84/54. This does not involve opening the lid of plain bearing journal boxes but did involve the No. 2 brake test in 84/54 because of the lifting of cars.

(d) There is an inspection done by passing trains. This can be a pull-by or standing inspection and will be one side or both sides depending on whether the train of the crew inspecting is still or moving.

This, of course, involves neither the lifting of the lid nor any kind of brake test.

(e) There is the running inspection performed by the crew of their own train in motion. It is required or at least encouraged at station mileboards and on curves. It is, of course, purely visual and involves neither lid-lifting nor brake test.

I have already made some comment about the inadequacy of the records or perhaps more aptly the indifference of the record-keepers of mechanical and interchange inspections. Other than that, I have nothing to say on the first four inspection procedures outlined above. All of those inspections took place before Guelph Junction and there is no evidence of any defects in the train apparent at the time. On the fifth, the running inspection from Guelph Junction, "the last defence" as it has been called, I can only say that either the crew or the system fell down badly. By that I mean either the crew or the system or both were not up to discovering the hot box in time to prevent the derailment. And yet I'm not sure what can be done with respect to either the crew or the system to prevent a repetition. I shall make some recommendations designed to improve the system and the performance of the crew but the real answer lies with neither but with the equipment. Mississauga

cries out for roller bearings and hot box detectors, the first to reduce the incidence of the cause of disaster, and the second to discover that cause before disaster overtakes the train.

(d) THE CREWS OF TRAINS

As we have seen, Train 54 had a reduced crew of 3. I have referred to the Hall report (p. 24) and the decision there made to authorize the elimination of the tail end brakeman on trains of 120 cars or less. Mr. Justice Hall made a very thorough investigation of all the pertinent circumstances including the paper work required of the conductor, the incidence of hot boxes, the need for manual flag protection, and reached the conclusion that the extra man at the rear was unnecessary. He did not, however, close the door. He said that his ruling was not to "be taken as the last word on this question of safety". He made specific reference to s. 227, particularly s-s. (i) (j) and (l) (supra, pp. 109 and 110). of the Railway Act which entitled the CTC to give continuing consideration to the number of men to be employed on trains in the interest of their safety and the safety of the public. It is now argued before me by the Unions and other interested parties that the reduced crew order should be rescinded in the interests of the

safety of the public. I can say only that the return to a full crew is not a lesson of Mississauga and I decline to make that recommendation. It was the front end that was nearest the hot box and Conductor Nichol in the rear did not indicate there was anything to block his opportunity to view. It is true that a rear end trainman would bring to the viewing an extra pair of eyes and the owner of those eyes might well see something missed by the conductor, but the position at the rear is quite different from that at the head end where the engineer regularly cannot look back because of his forward duties.

(e) THE SPEED OF THE TRAIN

We have seen that the CTC can regulate speed (Railway Act, s. 227(1)(a) supra) but rarely does and that in the absence of CTC regulations the railways can and do regulate speed (Railway Act, s. 230(a)). The limit set in the London Division timetable for this train at the point of derailment, indeed from Milton east, is 50 miles per hour.

The first question must, of course, be: does speed make a difference? However rhetorical that question may seem, it has been vigorously argued that the answer is "No" or at least "Not proven". The only figures tendered on the question were contained in a survey prepared in 1978

for the Interindustry Task Force Rail Transportation of Hazardous Materials in the United States under the direction of a steering committee of representatives of railways and chemical industries. The report is frank to say it cannot for lack of information draw any conclusion on the relationship between speed and the frequency of derailments but its preliminary figures seem to suggest that there is a levelling off of the danger of release of product after a derailment at about 30 miles per hour. I find this hard to accept. Whatever may be the relationship between speed and derailment, the damage suffered upon a derailment must increase with the speed. At any rate, it would take a report prepared by a much more disinterested body to persuade me to the contrary.

I certainly accept that speed is important to the railways and one should not force upon them uneconomic speeds except for good cause. I think, however, that we have here a very good cause at least in the absence of the employment of the other safety measures that will be recommended. This train with a cargo of dangerous goods, with some tank cars having plain bearings, with some tank cars not having completed or not being subject to a retrofit programme, with no hot box detectors en route,

proceeded through one of Canada's most populous areas where as we will see there is even some doubt that the whole of the train can be seen from one end to the other. To me, to proceed in such circumstances at 50 miles per hour, cannot be justified. I do not complain of the speed limit for some trains in some circumstances of 50 miles per hour or even more. I do complain of the application of that speed limit to this train in these circumstances.

It is unfortunate, in my view, that the CTC has not seen fit to regulate speed or at least review the speed set by the railways. The Railway Act, ss.230 to 233 provides that all by-laws and rules established by the railways "which affect the public generally" shall be approved by the Governor-in-Council. Speed rules established by the railways are not so approved apparently on the theory that they do not "affect the public generally". I should think it is debatable.

(f) LENGTH OF TRAINS

The length of trains is probably just as important to the railways as speed. Again I hesitate to make any recommendations for reduction in length. Nevertheless in some circumstances for the carriage of dangerous goods it may be necessary. Almost every regular or former crew member testifying was asked what number of

cars and what number of undercarriages he could see from the front or rear end. Inevitably the answers varied because much depended on the geography and topography of the track area but most indicated that the limit for viewing the undercarriage was under 20 cars on the straightaway and not more than 50 cars even on a good curve such as Winston Churchill Blvd. Of course, as the Cullen test showed us, one could see more if the fire extended out from the undercarriage, but even so it is clear that there are limitations of sight when the train is a long one. I am not sure that this means trains are too long for safety because in a fog or a blizzard one would probably be unable to see any undercarriages at all. What it does seem to indicate is that the running inspection—the last line of defence—is not very reliable.

(g) TRAIN MARSHALLING

The Red Book contains provision (see 74.589) for the separation of cars containing certain dangerous commodities from other cars and from the engine and the caboose. The object, of course, is to prevent injury to railwaymen and to prevent the interaction of two dangerous commodities upon each other in case of accident to the cars containing them. An example of the latter is the marshalling order of the CTC of December 18, 1979 following upon the Mavis Road derailment referred to at p. 123 supra.

I am certainly in no position to recommend the rescission of any marshalling orders now in effect. On the other hand I am not convinced that marshalling is the answer or any part of the answer to our problem. It is certainly common belief among the experts that the proximity of the Chlorine car to the bleveing Propane cars caused the escaping Chlorine to be funnelled up into the air where it was harmlessly dissipated. It is at least arguable that it is better to have dangerous commodity cars collected together in one train where special rules can apply. It is undeniable that the presence of 5 buffer non-placarded cars between the engine and the dangerous commodity cars will be more of a hindrance than a help if the burnt-off plain bearing journal on one of those buffer cars causes a derailment. I shall deal with marshalling again when we come to the many proposals put forward by the parties to the Inquiry.

## 2. THE RESPONSE

I am happy, of course, that the private sector, the manufacturers of the dangerous goods, are prepared in most cases on a 24-hour basis, to respond to a cry for help. I cannot, however, be happy that there is no

government control of the private response. Whatever may be one's views of the relative value of private and public enterprise, our concern here is with public safety. That surely is the ultimate responsibility of the state.

The Transportation of Dangerous Goods Act has given us the means of ensuring that control. It certainly is now and may well be always that the expertise must be left to the manufacturers. But government must ensure that that expertise is available and employed where needed.

There are enormous constitutional problems involved in the public response and most of them can be resolved only by agreement between governments. One thing, however, can be assured by the federal government and that is the availability of a knowledgeable and authoritative federal presence at the scene of a railway accident. Once again, the Transportation of Dangerous Goods Act makes that possible.

3. TANK CARS

As I have indicated there are problems demonstrated at Mississauga with tank cars which may or may not be soluble. These problems relate to the ability of the safety relief

valves to prevent or control release of product in a fire, the suitability of the present or proposed insulation for the same purpose, the adequacy of the bottom outlet protection and the timeliness of the present retrofit programmes. These problems are all being worked on but they are not being worked on in Canada. Their solution seems to be left to the AAR Tank Car Committee which may perhaps be affected by the recommendations of the National Transportation Safety Board. I have no doubt that the Canadian railways and the Canadian tank and car manufacturing companies and shippers contribute to the AAR deliberations, but it is not in my opinion enough to rely on private and American efforts. We are concerned with the transportation of dangerous goods in Canada. We must take advantage of all knowledge to be obtained from any source but we must also attack the problems from the viewpoint of the Canadian public and I am sure there is in Canada knowledge and talent available to help.

## 4. GOVERNMENT PARTICIPATION

Tank car research is only one way in which government can help. The investigation of railway transportation particularly of dangerous goods must be a continuing process. As I have indicated the CTC is charged with that task and

has done much valuable work to date. I am sure the Commissioners will agree that there is much more to be done. There is the limiting problem of staff and funding to which I referred. There is also, in my respectful view, a need for a change of emphasis from economics to safety and a policy that the problems of safety must be attacked immediately.

## IX. THE PROPOSALS

As will be seen from the attached Appendix 6 we were favoured with more than 40 formal briefs, almost all of which contained proposals and recommendations to enhance safety in the transportation of dangerous goods. (I prefer the word "proposals" to "recommendations" reserving the latter for the recommendations of this or other Inquiries.) But besides these briefs we had more than 150 witnesses, many of whom made proposals, and 18 (increasing to 20) interested parties who, in the course of argument, generally through counsel, made proposals and made comments on the proposals of others. In this chapter I shall attempt to gather together those proposals and express my views on them.

Before I proceed, however, I must state that I do not intend to deal with all of the proposals. Some of them seemed to me to relate more to the pending litigation between the parties and some, while very relevant to the transportation of dangerous goods, were not suggested by the Mississauga experience. There was a natural tendency to transform this Inquiry into one of general rail safety but that is not the way I perceived my mandate. I welcomed the advice of witnesses gained from their experience elsewhere but did not permit any investigation

of disputed facts of accidents other than the one in Mississauga. The problems of those accidents can be left to the agencies charged with their investigation and the recommendations flowing therefrom must be left to them. Mine is a Report on the Mississauga Railway Accident of November 10, 1979. These then are the proposals classified according to broad subject-matter.

## 1. TRAIN OPERATION

### (a) HOT BOX DETECTORS

There is unanimous agreement that hot box detectors are needed and should be installed. Canadian National began its programme in 1967 and says that today there are 186 detectors on its main lines and more are planned for immediate installation. CP Rail was at first skeptical of the merits of hot box detectors—see the evidence of Mr. Pike of CP before the General Safety Inquiry of 1971—but has now become a complete convert and plans to have them fully installed by 1985. Some indeed have recently been installed in the London Division. The C&O which has two hot box detectors in Ontario also agrees on their value and is considering installation on the Sarnia-Chatham line. The unions also support—indeed urge—a speed-up in installation.

There is no agreement on the kind of hot box detector which should be installed. The CN's, as I have said, sends its signal to a central monitoring office whereas CP Rail's is read by the crew. We also heard evidence of the existence of train-mounted hot box detectors and one was studied by CP for some years and finally rejected. The detectors in use appear to be effective. The only suggestion to the contrary was that while the hearing was on there were reports in the press indicating that the train which derailed near McGregor, Manitoba, had passed several hot box detectors without detection of trouble, but the cause of that accident as appears from the CTC's report was a fractured axle, not a hot box. There was no evidence before us justifying an interference in the railways' choice of type of detector. Nevertheless government could be of assistance in examining the kinds available, including the train-mounted ones and advising the railways. If one is found to be more effective the public will benefit as well.

In one area, however, I think it is essential that government interfere in the interests of public safety. There is no unanimity in the proper spacing of detectors. CN places them 25 to 30 miles apart, C&O considers 22 miles the proper interval, and as I have indicated (supra, p. 116) in the United States some railroads think 20 miles apart is

appropriate. The latter figure would appear to be closer to the lesson of Mississauga. Nothing was seen--although there could have been heat--at Guelph Junction, mileage 39; the first indication was at Campbellville, mileage 38, and the train derailed at mileage 16.5.

One cannot lay down a precise interval because the detectors cannot be placed anywhere on the track as they are subject to local conditions such as grades and switches, but the government can and should lay down a maximum interval. There is certainly little merit in having hot box detectors unless they will detect substantially all hot boxes. In the interests of public safety, government should determine the limits of hot box detector utility and regulate their installation accordingly. A detector at Guelph Junction might well have detected Train 54's hot box, but I doubt that it would have been adequate to prevent a burn-off that might have occurred 10 miles further on deep into Metropolitan Toronto.

And that brings me to what I consider important, viz. the protection of built-up areas. I believe that any dangerous goods train that passes through any built-up area without hot box detector protection during the whole of its passage must be subject to special rules.

(b) REAR VIEW MIRRORS

As we have seen, Train 54 being propelled by a GO Unit had rear view mirrors available but they were not used by the crew and the crew were not authorized to use them. Once again I do not want to tell CP Rail how to run its railway, but I find it difficult to understand the rationale behind this approach. True, there may be trouble with reverse image on switching, but I should certainly think that could be overcome by training. The C&O has had rear view mirrors on all new equipment since 1966 and some of the older equipment has been retrofitted. Mr. Ernest Jack Davies, the Canadian Director of the Brotherhood of Locomotive Engineers said that the feeling among the members of his union was that rear view mirrors would be a valuable complement to running inspections.

That brings me to CP Rail's real objection. It is that the head end crew will use the mirrors in place of actually looking back with their heads out the window. I don't know whether this is a real or phantom fear, but I suggest to CP Rail that they can always try them out. If they find that the mirrors are given a substitutional rather than a complementary use, they can remove them. I believe CP Rail has to date decided on principle relating

only to safety that the rear view mirrors are undesirable but it is not a belief that I share. I have a feeling reasonably close to conviction that had Engineman Pruss looked in his rear view mirror at any time after Derry Road, or had Trainman Krupa looked in his at any time from McConnell Road, this Report would never have had to be written. In any event I shall recommend that rear view mirrors be tried.

(c) INSPECTIONS

(i) RECORDS

We have already seen that the records kept by carmen are inaccurate; indeed the carmen are indifferent to accuracy and their superiors seem no less unconcerned. Commission counsel have proposed that there be "complete and sensible records of maintenance repair and mechanical inspection of all rolling stock" and that the form of those records should be established by the CTC. I should hope that the railways in their own interest would do something about the records and I shall recommend that the CTC require that such action be taken. It might, as well, be of assistance in the CTC's Monitoring of Train Operations Programme.

(ii) MECHANICAL INSPECTION

By whatever name the derailed cars, and in particular Car 1, had a full mechanical inspection at Sarnia and again at Chatham only 53 miles away.

Thereafter there was no mechanical inspection and none was intended until the train reached Agincourt over 180 miles from Chatham. The carmen's inspection at London and the inspection of the crews of the "meets" at Nissouri, Puslinch and Guelph Junction all helped, but none would solve our problem unless the hot box had already reached the smoking stage. Commission counsel proposed a complete mechanical inspection at least every 500 miles and that the CTC should be advised of and approve the location of inspection points. CP Rail now performs mechanical inspections on a "nominal 500 miles basis". Mr. Jean Paul Raymond, the Vice-President of the Brotherhood of Railway Carmen, suggests on behalf of his membership that 200 miles or "300 miles at the very most" would be the appropriate interval. None of these figures is related to the Mississauga experience. Mechanical inspections in order to catch a hot box would be at prohibitively short intervals. The solution to our problem appears to lie in hot box detectors.

A brief presented by the Brotherhood of Railway Carmen expressed concern over the reduction in the number of qualified carmen employed by the railways and the reduction in the number of locations across Canada where mechanical inspection are carried out. It was also suggested that there had grown up a fairly prevalent practice of railway supervisors removing bad order cards from rolling stock in order to permit a car to continu in service. A bad order card indicates that a car requires repair and therefore should be removed from a train to effect

such repair. I did not conduct any specific inquiry into the allegation concerning bad order cards and I therefore will not make a recommendation in that regard. However, I will recommend that the railways be required to set forth rules for inspection and the location of the inspection points at which inspections are made, all to be approved by the CTC.

(iii) RUNNING INSPECTIONS

As we have seen there are 2 basic flaws in the performance of running inspections. The first is that there is no consistency in where the inspection on curves takes place, and the second is that there is no consistency in the language of communication during and after inspection on curves. Mr. Davies of the Brotherhood of Locomotive Engineers seemed of the opinion that the procedure adopted (leaving it to the discretion of engineers) resulted in every engineer and every head end trainman inspecting at the same place on a given run. As we have seen (ante, p. 46) this is not so, at least in the Mississauga area. There is also the conflict of view (pp.56-7 ante) as to the primary obligation of the head end trainman when the train is encountering problems in front which engage the engineer's attention. I do not think all discretion should be removed from the engineer and the head end trainman (or for that matter from the conductor) but I do think they are entitled to some guidance. So far as I can determine the only guidance they get at CP Rail is in the initial training and that is very subjective depending on the views of the teacher.

A more difficult problem is that of consistency of the language of communication. Commission counsel propose a standardized vocabulary. The purpose of communication is only to be understood. If the only communicants are the head and tail end it is good enough if they understand each other. If it is proposed that the communication be monitored by a third party to determine whether the proper running inspections are being carried out, then standard language is essential. I shall recommend the adoption of such a standardized vocabulary but only for the time being in association with the trial of radio equipment and the recording of communications infra.

(d) RADIO COMMUNICATIONS AND RECORDING

There was no suggestion before us that communication between head and tail end was unsatisfactory. There was much evidence that the record of those communications at the London dispatcher's office was incomplete. It seems that the recording device at the time could only pick up those conversations if (1) the dispatcher's set was tuned to the main line frequency (as opposed to the yard frequency), (2) the conversation was within range, and (3) the conversation was not overridden by a transmission from another train on the same frequency that was more powerful. It seems that it was not intended that the transcript

should be complete, only that it should provide what help it could within its limitations. The reason that intra-crew communications could be picked up in London from Mississauga and not at places along the way is that a repeater station was installed in mid-1979 in Streetsville. Commission counsel have proposed the installation of radio equipment that would allow both head and tail end communication to be heard in the dispatcher's office and recording equipment there to record all such communications. It is a good idea and worthy of trial. It would be of no use unless it is monitored regularly. It would not have prevented the Mississauga derailment, but it might well have told us how well the crew were performing the running inspections.

(e) EVENT RECORDERS

Commission counsel have proposed the installation of locomotive event recorders to monitor braking, throttle movement and speed. CP Rail is opposed largely because of labour resistance. The question I think is now academic. As I have noted (ante, p. 122) as a result of the investigation of a derailment near Glacier (sometimes the derailment is stated to have occurred at Flat Creek), British Columbia, the investigating officer has recommended the installation of such a device in all locomotives and the CTC has accepted and is about to implement the recommendation. It could only promote safety and I can only approve.

(f) TRAINING OF ENGINEERS AND CONDUCTORS

The same investigation (Glacier, B.C.) resulted in another recommendation that the RTC, through its committee of representatives of railway, labour and the RTC, draft a regulation outlining standards for engineers and conductors and requiring that engineers and conductors pass an examination based upon those standards as a condition of employment or continued employment. The railways, both CP and CN, have now training programmes. It can do no harm to set a minimum standard. Again the problem is academic. The recommendation of the Glacier, B.C. report has been accepted by the CTC and is in the process of being implemented.

(g) TRAINING OF CARMEN

Commission counsel propose that formal programmes for training be adopted and implemented, monitored by the CTC. The carmen's union is happy to have its members subjected to further training and is happy to have the CTC or the RTC adopt and implement "more rigid rules and regulations governing the inspection, repairs and maintenance of rolling stock on the railways". I should

think that the results of the CTC's Monitoring of Train Operations Programme would dictate not only the further training but the adoption and implementation and enforcement of such rules. CP Rail has an impressive document entitled "Training Manual of Basic Freight Car Inspections and Repairs" which calls for extensive training programmes, but the evidence before us both from CP Rail and C&O personnel was to the effect that the carmen who inspected the Mississauga train got their training on the job without supervision except from their immediate supervisors.

(h) VANS OR CABOOSES

Commission counsel propose that vans should be equipped with speedometers, windshield wipers and window defrosters and this proposal is supported by (perhaps promoted by) the United Transportation Union. It was not a problem at Mississauga but on general principles one can only wonder why this equipment has not been installed before. CP Rail questions only the rationale for speedometers. I think the rationale is obvious. The

conductor who is in charge of the train is required as are all employees—see Uniform Code General Rules - E—to report any violation of the rules. If he is to be blamed for excessive speed on the part of the engineer, he must have a ready, fast method of determining that speed so that he can take immediate steps by radio (or in extreme cases application of the emergency brake) to ensure that the violation does not continue.

Mr. McLeod of the United Transportation Union also proposed that the cupola be extended beyond the sides of the caboose for better viewing as it appears to have been in some of the newer models and the Union and Commission counsel propose that a low, unloaded car be marshalled immediately in front of the caboose to give greater visibility. Both proposals seem sensible but CP Rail claims both propositions are impractical and the C&O agrees at least as far as the low, unloaded car is concerned. I think the practicality should be judged immediately and if the judgment is affirmative, an appropriate regulation or reglations promulgated.

## 2. CARRIAGE OF DANGEROUS GOODS

### (a) ROLLER BEARINGS

Commission counsel propose that trains carrying

dangerous goods should not include cars with plain bearings, i.e. they should all have roller bearings, and that an appropriate lead time for conversion to roller bearings be established. I agree with the first proposition; I disagree with the second. Roller bearings have been with us for decades. The conversion among tank cars is almost complete, that among railway-owned box cars in Canada not yet 50 per cent complete. We know that journal failure with roller bearings is only a small fraction of that with friction bearings. We also know that a train is only as safe as its weakest car. As Mr. Jones, the former chairman of the RTC, put it in the General Safety Inquiry:

> "There is no guarantee that the car ahead of this vehicle on which so much time and money is being spent will not be some car that is old and decides to become a cripple at the wrong time and create a derailment which has the chain reaction effect...".

It seems to me that the railways have had sufficient time for conversion. No further time should be given in the transportation of dangerous goods. No cars in a dangerous goods train should be equipped with plain bearings.

(b) TANK CAR EQUIPMENT

Commission counsel propose that all cars carrying dangerous goods should be equipped with double

shelf couplers, head shields, thermal protection and bottom outlet valve protection, again with an appropriate lead time provided. I agree that double shelf couplers should be on all tank cars and bottom outlet valve protection should be provided for all tank cars carrying dangerous goods. I agree that all 112 and 114 cars should have head shields and thermal protection. I don't know whether the same should apply to 105's. The matter is still under consideration in the United States. There is as I have noted no independent consideration in Canada.

I may say that the provision of double shelf couplers, head shields and thermal protection for 112 and 114 tank cars is more or less academic. The CTC regulation requires double shelf couplers by March 31st, 1979 and head shields and thermal protection (the latter only for cars loaded with flammable gases) by June 30th, 1981.

(c) SPEED

Commission counsel propose that dangerous goods trains be required to travel at reduced speeds, particularly in heavily populated areas and in this they are supported by many individuals and by almost every municipality which submitted a brief. Not surprisingly it is vigorously opposed by the railways.

I am satisfied that a case is made out for review of speed limits based on particular circumstances. I am not satisfied even on the reverse onus which I have suggested should apply in the transportation of dangerous goods that a case is made out for a general reduction of speed. I fully appreciate that speed alone can create discomfort in adjoining properties and that is a legitimate municipal concern, but it is no part as I see it of my terms of reference. To order a reduced speed in the interests of safety is tantamount to an admission that we cannot produce a safe train. In my view a reduced speed should only be required if the other safety measures are not in place.

I have already referred to the problems in the setting of speed limits and I will refer to them again in the recommendations.

(d) LENGTH OF TRAIN

I need not repeat how a long train may reduce the effectiveness of the running inspection. Commission counsel suggested a limit on length of 3,000 feet and Mr. Rodger O'Brien, the vice-president of the United Transportation Union, suggests 4,000 feet which would reduce a dangerous goods train to something between 50 and 70 cars. There is certainly attraction in either proposal because it would make the undercarriage of all cars visible from one end or the other on a reasonable curve and in clear weather. Where the running inspection is all we have, I would agree with the proposal. But where the other safety measures are in place,

I do not believe that such a restriction having so obvious and so enormous an effect on the efficiency of the railway is necessary.

(e) MARSHALLING

CP Rail in the course of argument presented some very comprehensive proposals of which marshalling was the keystone.

The proposals started with an appreciation that there was before the Inquiry Exhibit 425 entitled a "List of Special Dangerous Commodities", a list which was prepared for the Dangerous Commodities Technical Review Committee in the course of consideration by the CTC of "solid trains" (i.e. trains carrying only dangerous goods), re-routing of dangerous goods trains out of densely populated areas and controlling the speed of dangerous goods trains. The list includes over 30 commodities most of which are poisonous, but some of which are flammable or non-flammable compressed gases. The list includes Chlorine but none of the other dangerous goods involved at Mississauga. Mr. Ellison doubted that many of the products listed had significance in commerce. The list by its very nature had to be tentative but it was nevertheless a starting point for delineating the most dangerous of dangerous goods.

With this list as a basis Mr. Shibley, for CP Rail, proposed that all tank cars carrying the listed goods ("the 425 goods") be marshalled in the front of the train. These cars would need to be separated by 5 non-placarded cars from the locomotive by Red Book regulation, (74.589) and by the marshalling order after Mississauga (ante, p.123) there would have to be a separation of the "425 cars" from those containing flammable compressed gases by another 5 non-placarded cars.

The proposal went on to require that all tank cars containing the 425 goods be completely equipped with roller bearings forthwith and be retrofitted with double shelf couplers, head shields, and thermal protection and bottom fitting protection by December, 1982, and that until the route was protected by hot box detectors there would be a standing inspection every 75 miles of the portion of the train containing the 425 goods. Finally, none of the LPG's marshalled to the rear of the 425 goods could be shipped without having been completely retrofitted.

The merits of the proposal are that the most dangerous commodities would be in cars inspected more often and those cars would be closer to the view of the head end for running inspection; moreover those commodities would be unlikely to be affected by a derailment further back

on the train. It was suggested also that the completion of the retrofit programme for LPG tank cars would at least minimize the danger of spill in a derailment.

The merits of the proposal are, however, in my view, overridden by one glaring flaw. The 5 buffer cars before the 425 goods and the additional 5 buffer cars before the remaining LPG tank cars (to say nothing of the non-dangerous goods cars in the latter portion of the train) are not necessarily to have roller bearings, and the incidence of derailments from hot boxes not only at the back but at the front as well is bound to remain high. In a memorandum from Mr. Lucas, the director of the Centre of Forensic Science to Mr. Blenus Wright, counsel for the Attorney General, he doubted that if all derailed cars had had double shelf couplers and head shields, there would have been significant change in the circumstances of the Mississauga accident. He agreed that bottom fitting protection might have lessened the severity of the fire resulting from the loss of product (Toluene) in Car 1, and the loss of product (Caustic Soda) in Cars, 3, 4, 5 and 6. He conceded that thermal protection is potentially very valuable particularly in avoiding explosion, but doubted that the type of coating or jacket now available is of demonstrable help.

There were other proposals involving marshalling, many involving the separation of Chlorine tank cars from other dangerous goods, some involving the separation of Chlorine tank cars from any train carrying other dangerous goods. As I have said, I am not sure that Mississauga demonstrated any merit in the separation of Chlorine from other dangerous commodities.

Nor am I convinced of the merits of the marshalling regulations now in force from the CTC. I would not, however, interfere with any of them. There is doubtless some benefit to the crew in the event of a derailment. These regulations do not reduce the likelihood of derailment and I am far from sure that they benefit the public in the neighbourhood of a derailed train.

Before I leave the subject, I do not wish to discourage the further study and classification of dangerous goods to separate the most dangerous from the others and attaching to the former special, more rigid rules. I am not yet convinced of the sufficiency of a list which does not include Propane or most other LPG's or other goods such as ammonium nitrate which is not only toxic but transported in large quantities.

(f) RE-ROUTING

I have much the same reaction to re-routing.

The major proposal to that end came in a comprehensive brief from the Municipality of Metropolitan Toronto. That brief points out that the CP Rail track from southwestern Ontario travels through the heart of Metropolitan Toronto to reach the yards at Agincourt where much of it is then dispatched to western Canada and much of the traffic from western Canada follows the same route in reverse. This brief suggests that all dangerous commodity trains of CP Rail be re-routed either along the present CN freight line, or along a new CP line both to the north of Metropolitan Toronto through such municipalities as Brampton, Vaughan and Markham, much of which route in either case would be in the Province of Ontario's transportation/communication/utility corridor.

I need hardly state that the proposal was not endorsed enthusiastically by Brampton, Vaughan and Markham, but I do not wish to appear to dismiss the proposal as frivolous. Certainly re-routing is possible and certainly it can have advantages in safety. So long as we have derailments of dangerous commodity trains it is better that they take place in sparsely populated areas. But the magnitude of re-routing track outside populated areas is staggering. It also does nothing at all for the delivery of dangerous commodities to populated areas. The subject should, of course, be studied (or perhaps should continue to be studied—it has from Mr. Gray's evidence already been considered for 2 years) and where it can be done it should be.

I need hardly point out that there is no merit in re-routing if the municipal authorities in an expanding area permit (as they have in the greater Toronto area) building, both commercial and residential, up to the edge of the right-of-way.

Re-routing, like marshalling, can be of assistance and should always be considered in long-term planning. But neither re-routing nor marshalling is the answer we seek now. That answer, in my view, lies in safer trains.

(g) THE FOUR-MAN CREW

Commission counsel supported the Union's request for the return of the 4-man crew on dangerous commodity trains. For the reasons given ante (pp.145-6) I cannot accept the proposal. That of course does not mean that safety and the number of the crew necessary to support that safety should not be a continuing concern of the CTC.

(h) TRAINING OF CREWS

The Unions were unanimous that more training was needed for crews in the transportation of dangerous goods. Such training is needed in marshalling, emergency

response, inspection and first aid and in the nature of the product handled and at least at the time of the derailment such training was quite inadequate. There is no real opposition to these proposals. I at first had thought there should be specially trained crews for dangerous goods trains but I now think that is unworkable and the only solution is universal training. The important thing is that the training be comprehensive and compulsory. The trainees would, of course, have to be paid for the time spent in the training.

(i) THE CONSIST

I don't think there is any real argument about the absolute necessity for the immediate provision of information of the make-up of a derailed dangerous commodity train.

Some municipalities and services have gone so far as to suggest that prior notice be given by the railways of the intended passage of each train carrying dangerous goods. Bearing in mind the myriad number of municipalities through which a train would pass in an average train run, I consider this an unnecessary burden to place upon the railways for little real benefit. What is needed is an accurate, intelligible consist available on request immediately. It

should be available from the conductor on the scene and from the Division Headquarters of the railway and from or through CANUTEC on a 24-hour basis.

(j) TRANSPORT CANADA'S "MANAGEMENT PLAN"

Counsel for Transport Canada has proposed that railways file a "management plan" setting forth among other matters the persons having responsibility for inspection of dangerous goods cars and their qualifications, the routes of transportation, an inspection programme, including the distances between mechanical inspections, the availability of hot box detectors and the speed restrictions established with the criteria for their establishment.

In so far as this demonstrates a deepening concern by government in the transportation of dangerous goods, I commend the initiative of Transport Canada. It can proceed with its proposal without any recommendation from me; indeed much of the proposal is covered within other sections of this Report. I should just like to add the obvious. There is no merit in requiring the submission of a plan unless that plan is critically examined and when approved, enforced.

3. RESPONSE

(a) THE RAILWAYS

As we have seen the railways have response plans to dangerous commodity spills. I have made reference

to the flow chart of CP Rail; the same railway also has a manual setting forth in great detail the agencies that can assist in a dangerous goods spill. The initial burden of a derailment will always fall upon the railways and often that burden will go no further. When the accident is confined to the right-of-way and the results do not affect the health or safety of the adjacent citizens, there is no need to consider measures to be taken by others. We must appreciate however that in a dangerous spill the crews and the railways can have only a limited function. The only proposal for improvement of the railway response other than the proposals for improved training of crews (ante, p.175) was one put forth by Dow; it called for response programmes on the part of railways as well as shippers with emphasis on cooperation between railways and shippers, both in the initial response and in the operation of the command centre. Mr. Francis, however, specifically disclaimed any wish to see the proposal translated into law.

I have no complaint of the railways' well-developed plans for response to accidents. I have no recommendations for improvement. I do think however that these plans should be published in the sense that they will be known to CANUTEC and the other agencies, private and public, who will be involved in a dangerous goods spill.

(b) THE PRIVATE SECTOR

As I have said we are largely dependent upon the private sector in the event of a chemical spill. As I have also said for that very reason the private sector

must be dependable. I here refer not only to their competence in the performance of the response, but also to their competence to respond at all.

As counsel for the Canadian Chemical Producers Association was frank to point out, there may be many small producers who manufacture at only one site in Canada and many foreign manufacturers who may not have any connection with Canada except as an exporter to this country of the product. With the best will in the world these producers will not have a response team available unless they are required to do so or unless the industry supplies the team for them.

CP Rail has proposed that the producer/shipper be compelled to supply a response team and has outlined in considerable detail what personnel that team should be composed of and what should be their qualifications and duties. Transport Canada, as I understand it, is prepared to require the private sector to have a response plan in place as a condition of shipment.

I agree with CP Rail that a response team must be compulsory and I agree with Transport Canada that the only assured method is to require a plan as a condition of shipment. I realize that this may impose a hardship on small or foreign producers, but very simply put that is the

price they must pay for the delivery of dangerous goods. I suspect that the difficulty can be worked out within the industry and, if not, any obvious injustice can be ameliorated by government negotiation or regulation.

Many of the briefs were concerned with the question of legal liability both criminal and civil for the private response team. Some industries are themselves, not surprisingly, in favour of complete immunity and this position is supported by both Mississauga and the Province of Ontario. The Transportation of Dangerous Goods Act provides (in s. 17(6)) that "Any person requested to act (see p. 128 ante) is not personally liable either civilly or criminally in respect of any act or omission in the course of complying with the request unless it is shown that he did not act reasonably in the circumstances." I do not know what that provision adds to the common law.

Like CP Rail I can see no reason for granting immunity to the private response teams or their employers, whether or not they are a "person requested to act". True, to a certain extent they have been volunteers in the past, but it must always be remembered that they are the producers of dangerous goods and the beneficiaries of their transportation. I can think of many circumstances where they should not be liable but many where they should; it is a very complex problem. Speaking perhaps from an understandable bias I would leave the problem like most other tort problems

to the courts. In this I will not have the support of the Canadian Environmental Law Association who would prefer some form of absolute liability together with a compensation fund so that the public would not have to "fall back on the discredited common law actions". Certainly those who have been affected in Mississauga have had no hesitation in seeking their remedy in the courts.

(i) ENVIRONMENTAL CONSIDERATIONS

The Canadian Environmental Law Association was not unnaturally concerned with the effect of a spill on the environment; it found many defects in the Transportation of Dangerous Goods Act particularly in its failure to concern itself with "hazardous waste". However that may be, I do not consider that the very complex environmental problems were within my terms of reference.

(c) THE PUBLIC RESPONSE

In this area CP Rail proposes the establishment of a command team composed of fire, police, railway officials, the response teams of industry and a non-elected government (presumably federal government) emergency commander together with independent experts appointed by him.

I agree that fire and police should always be part of the team where required and railway officials should always be part of any team—indeed as I have said they may often and perhaps generally comprise the whole team. In my view the proposal for a non-elected emergency commander is probably unconstitutional and wholly unrealistic. Where a spill is within a province and does not take on the proportion of a national emergency, the municipal or provincial governments are not only the lawful but the natural authorities and those governments are composed of elected politicians. Not only would those politicians expect to be in charge, they would be expected by the people they represent to take charge. Strangely enough (or so it seemed to me) the City of Mississauga proposed "that the Ministry of Transport be responsible for coordinating the on-site activities of the various response groups and assume ultimate responsibility for the clean-up operation". At the same time they proposed that the municipal government be given "clear authority to take all emergency measures... to prevent...the danger to life, health and property of its citizens". I don't think you can separate clean-up from command. Nor do I think you can dissociate command from ultimate responsibility.

I do not, however, believe there is any reason or any justification for the federal government abandoning

responsibility in all but national emergencies. I think the obligation remains to have a person or persons available and knowledgeable to attend at every accident where required, to assist and advise the municipal and provincial authorities, to coordinate the railway's and the private response and to take charge in a vacuum. I think also that that is precisely what is contemplated under s. 17 of the Transportation of Dangerous Goods Act.

As I have said, I do not consider that the conduct of the municipal or provincial authorities are within my terms of reference. I might just point out though that the Province of Ontario already contemplates an "Emergency Plans Act" providing for municipal and provincial response to an emergency.

## 4. OWNERS AND SHIPPERS

I have already dealt with the proposals for improvement of tank car equipment (ante, pp.167-8) and I intend in the recommendations to ensure that trains carrying dangerous goods have the benefit of that improvement. I also intend to recommend more Canadian research into tank car safety and more Canadian consideration of the speed of

implementation of the retrofit programme. There are, however, two subjects that might conveniently be considered here.

(a) PLACARDING AND COLOUR-CODING

One of the problems of Mississauga was the inability of the emergency services to identify the contents of the derailed cars immediately. The consist will, of course, help but it can be readily seen from Appendix 2 that the cars on a derailment do not necessarily maintain the same order. At the moment, the chief identification (dictated by the Red Book) is a cardboard placard usually about a footsquare placed in a bracket on the tank car by the shipper at the time of loading. We were told (it was hardly necessary) that these placards suffer great damage from exposure and often are destroyed in transit. While the carriers are compelled to carry replacements and doubtless make the replacements when the loss is discovered, it is not a very satisfactory system and many proposals were made to correct it.

Some of these proposals such as Commission counsel's that the placards be made of non-flammable material reasonably able to withstand our weather conditions should clearly be implemented. Another proposal is that the car

numbers be raised so as to be more readily identifiable and more impervious to fire. Some proposals such as colour-coding of the tank cars are much more difficult to implement because of the many uses to which a tank car can be put, and the host of dangerous goods now on the market. Nevertheless there does appear to be a movement towards dedication of a tank car to transportation of a particular commodity and the number of dangerous goods regularly transported is not so great. It seems to me that a system of colour-coding, not necessarily involving painting the whole car, could be worked out for tank cars regularly carrying the more dangerous and more commonly transported commodities. I fully appreciate that in a conflagration like Mississauga any colour-coding would be destroyed. Nevertheless it is easy to visualize situations where colour-coding (which will have to be well publicized) would be of great assistance.

(b) INSPECTION OF THE LOADED CAR

The inspection of the tank portion of the tank car is, of course, part of the loader's duties and is readily accepted by him. The difficulty however arises in the undercarriage where the locations of the loading point and the location of the first mechanical inspection point are well separated. According to figures supplied to us by CP Rail that distance can be up to 100 miles.

The Red Book (s.74.596) requires that placarded, loaded tank cars "be inspected by the carrier before acceptance at the originating point and when received in interchanges to see that they are not leaking and the air and handbrakes, journal boxes and trucks are in proper condition for service".

The difficulty is that the crew who go to pick up the tank cars are not qualified to make a full mechanical inspection (which the required inspection appears to be) and CP Rail proposes that the inspection be made at the shippers' premises by shippers' personnel. The shippers are opposed, pointing out that none of their personnel is qualified for the task to which CP counters that it is willing to supply the necessary training free of charge.

I do not think that there is justification for changing the present rule, and the burden should remain with the one most qualified, viz. the carrier. If the crew cannot be trained, a qualified carman must be sent, but I see no reason why the shipper cannot be made to bear the cost.

I might just point out that there was no evidence of mechanical inspection by the C&O of any of the cars at any of the "originating points" prior to Mr. Nethercott's inspection of Local 4 while it was being made up. It appears also that Dow does do an inspection of the undercarriage but that inspection is before loading and does not involve a

full mechanical inspection and did not, at least up to the time of this derailment, include the lifting of the journal box lids.

## 5. THE GOVERNMENT

### (a) INSPECTORS

I have already referred to the need for a federal presence where required at the scene of the accident. Presumably he will be an inspector under s. 17 of the Transportation of Dangerous Goods Act and he will, of course, be knowledgeable about dangerous goods, their properties and the emergency response. There is little, if any, opposition to the proposal. The only problem will be to train men and women to the knowledge and competence required.

### (b) ROLE AND DIRECTION OF THE CTC AND TRANSPORT CANADA IN THE CARRIAGE OF DANGEROUS GOODS

It is obvious from the Transportation of Dangerous Goods Act that henceforth Transport Canada will take a direct interest in the subject that concerns us. It seems equally clear (see ante, p. 128) that the CTC will continue

to be concerned. I do not know how their competing or complementing roles will be resolved and that is not my problem. What is of concern to us and was to many of the parties appearing at the Inquiry is the direction of government and the extent of its involvement in the solution to our problem.

I have mentioned earlier the lack of funds that has hampered CTC to some extent. I have mentioned also the philosophy of restraint based largely on economic principles. Perhaps Mr. Gray put it best or at least most directly. After describing the need to consider the economic effect on railways, he said "If you impose by force a programme on the railway companies and they don't have enough money to implement, all you have done is issue an order to increase freight rates...It is too important a subject-matter to take any great big initiate (initiative) that is going to cost a great big amount of money unless you know what you are doing ahead of time because you can do more harm than good" and again "But I think that the type of examination that I have described to you has to be done and that to implement recommendations without doing it would border on the irresponsible."

These words might be contrasted with those in the Canadian Railway Labour Association brief. In discussing

what was alleged to be the policy of CTC "to permit the railways to police their own operations and write their own rules via the Railway Association of Canada and accept standards set by the AAR..." it said: "In our opinion, as in the case of hot box detectors and roller bearings where the economics of the railway companies naturally become an obvious consideration, the balance must tip in favour of safety."

I think it is a difference in philosophy but whether it is that or just a difference in emphasis I side with the Unions. Where there is a major danger such as exists in the absence of roller bearings and hot box detectors, one needs very little evidence of economic feasibility to justify an order. The evidence is that a conversion to roller bearings costs from $3,350 per car to $15,000 per car depending upon whether one accomplishes the task merely by modifying the existing bearing or by replacement of the whole truck. The cost estimate to CP Rail of the installation of a hot box detector including a dragging equipment detector in 1978 was $73,800. On these figures, I have no difficulty in tipping the balance in favour of safety. The benefit to the public is clear. And if the detriment to the railways is insupportable, the public might well condone a subsidy.

These observations may perhaps be regarded as designed at least in part to justify my recommendations. They are designed however also to support further initiative by government in the direction of safety in line with the proposals of many municipalities, associations and individuals. The Monitoring of Train Operations Programme has given us valuable information and cannot help but improve the inspection system. It should as Commission counsel propose be continued and expanded as funds for more inspections become available. The CTC should also expand its accident investigation process perhaps along the lines of the National Transportation Safety Board in the United States and should publish reports of its investigations. I do not know what fruits the McGregor Report will bring forth because essentially it asks for a plan of improved safety from Canadian National, but in my opinion the very publication of that report and the consideration that the public and CN will give to it must improve safety.

There has been considerable adverse comment on the deliberate policy of the CTC against prosecution of breaches of the Railway Act or of the regulations. There are numerous sections of the Railway Act—see s. 343 et seq. setting out offences, and a general penalty section is found in s. 395. But access to the public in prosecuting for

these offences is very limited. Under ss. 343, 361 and 376-381, no prosecution for specific offences can be undertaken without leave of the CTC, and s. 399(4) provides that no prosecution for any offence can proceed against a railway where the penalty might exceed $100 without that leave. As I understand it, the CTC has not of its own prosecuted at least since 1967; there may have been one prosecution brought at the instance of private citizens during that period.

Again it is a question of philosophy, the CTC's being to persuade rather than prosecute. For a different view, one might quote from the reasons of Riddell J. in R. v. Michigan Central Railroad Co. (1907), 10 O.W.N. 660 at pp. 668-9:

> "I reiterate that it is my firm, well considered opinion that the best way to prevent similar occurrences, accidents or crimes, whichever word may be selected, is to make it more costly for railway companies to violate the law than to observe it. The great defect in our system is the want of some officer whose duty it is to watch for offences against the law and cause offenders to be prosecuted. Substantive law and legislation we have enough and to spare, but we have always failed to provide prompt and sure methods for the detection of offences. The practice of shipping explosives in the manner disclosed in this case has apparently been going on for years without detection, and it would not even now have been discovered had not the explosion happened. Neither does it always follow that, when an offence against the law does become obvious, it is prosecuted."

Mr. Justice Riddell's view found considerable support among the non-railway parties at the Inquiry. I do not think it necessary or perhaps desirable for me to make a specific recommendation in this regard. However, when Parliament has legislated an offence and a penalty, the enforcement agency should be slow to adopt a policy of no prosecution for that offence. To the extent that the Minister of Transport or the CTC believe that the existing offence and penalty sections are out-dated or inadequate to achieve reasonable enforcement of the Railway Act, the Minister should consider placing before Parliament appropriate amending legislation.

I have already expressed my view that there should be Canadian sponsored research on the safety of tank cars and the transportation of dangerous goods by rail. As Commission counsel expressed their proposal, we should seek to develop -

(a) a device which is capable of measuring what amount of product remains in a tank car or a container after an accident;

(b) a computer program that will be capable of predicting the risk of any danger posed at the accident site, especially dispersion of clouds of dangerous goods that are harmful to life;

(c) safety valves or other devices that will operate in catastrophic conditions so as to minimize the rupturing of tank cars and containers.

Success in any one of these endeavours would perhaps have overcome the problems of Mississauga and would perhaps overcome the problems of any similar derailment.

A tank car manufacturing company (the Canadian General Transit Company) expresses it thus: "A trade association or a branch of the CTC ought to be created to re-evaluate performance standards of all safety devices and analyze all retrofit proposals on a cost/benefit/risk basis. This body ought to have the research capability and liaise with the DOT, FRA (Federal Railroad Administration), RPI (the Railway Progress Institute—suppliers of equipment to railways), AAR and appropriate trade associations such as the Chlorine Institute." I approve the sentiment.

These proposals, in my view, are dictated by the experience of Mississauga. All that stands in their way is the will (and the financial backing) of government.

## X. THE RECOMMENDATIONS

### RECOMMENDATION ONE

Subject to Recommendation Three, trains transporting dangerous goods of any kind should be equipped as follows:

(a) all cars whether dangerous goods cars or not should have roller bearings;

(b) all tank cars should have double shelf couplers;

(c) all 112 and 114 tank cars should have head shields and thermal protection;

(d) all 111 and 114 tank cars which have bottom fittings should have bottom fitting protection.

### RECOMMENDATION TWO

Subject to Recommendation Three, the routes of any trains carrying dangerous goods through built-up areas should be protected by hot box detectors. No point within the built-up area should be more than 20 miles from hot box detector protection.

RECOMMENDATION THREE

If a dangerous goods train does not comply with Recommendation One, it should not exceed 4,000 feet in length regardless of the hot box detector protection provided.

If the dangerous goods train does not comply with Recommendation One, or if the route of the dangerous goods train passing through a built-up area does not comply with Recommendation Two, the train in passing through the built-up area should not exceed 25 miles per hour.

COMMENT

The object of these first three recommendations is to ensure that any dangerous goods train without the accepted technical safety improvements will not exceed the 4,000 foot length over which the crew would have a reasonable opportunity of viewing the undercarriage, and also to ensure that any dangerous goods train passing through a built-up area without hot box detector protection will proceed at a safe speed. It is possible under these recommendations for a longer dangerous goods train to pass through an urban area without hot box detector protection, but only at the slower speed and only if all technical improvements have been effected.

Lest there be any doubt about it, I am not recommending any lead time for the technical improvements or the installation of hot box detectors. That time has already run and the recommendation should be implemented immediately. I am not unmindful that the limitation on length and speed may hasten the retrofit programme and the installation of hot box detectors, but that is not the reason for immediacy. It is, in my opinion, in the words of Term 2 of the Terms of Reference guiding me, one of "the steps which can be reasonably taken to reduce the risk of recurrence of such an accident anywhere in Canada".

There may be a need to define "built-up area". I have in mind any concentrated centre of population in the proximity of the track containing 500 or more people. It need hardly be said that the railways should work towards the installation of hot box detectors on all routes but the immediate need relates to the transportation of dangerous goods through urban centres.

The imposition of the 20 mile interval for hot box detectors is indicated by the practices in North America and the experience of Mississauga (see ante, pp.116 and 156). If a train-mounted device could be perfected the whole question of interval would, of course, disappear.

It has been suggested that no recommendation involving a change in equipment can be effected without United States cooperation because of the great international traffic in rail cars across the United States border. I do not think the problem is insuperable. The recommendations I have made are in line with United States trends—in many ways, such as roller bearings, they are ahead of us—and Recommendation Three takes effect if the first two recommendations cannot be complied with because of international traffic.

It must also be noted that I have made no distinction among dangerous goods. I appreciate that many of the goods that are transported are so classified but are only marginally dangerous. The time may come when a reliable classification has been made enabling the less dangerous goods to be exempted from these rules. That time, however, is not now. I am not satisfied for the reasons given (ante, p. 173) with the 425 goods list and no other list has been offered.

RECOMMENDATION FOUR

As a condition of shipment anywhere in Canada of dangerous goods by rail, the shipper should have in

effect a plan for control of the escape of his product in an accident and that plan should be submitted to and approved by the Minister or such agency or person as he may designate. The right to ship may be revoked at any time the plan, either in concept or operation, is deemed inadequate.

COMMENT

This recommendation which is basic to the reliance upon the private sector will take a little time to implement but I do not intend that the implementation be long delayed. Most of the shippers already have plans in effect and I should think all shippers could submit their plans within three months. The nature of the plans will, of course, vary with the product and the response may, by arrangement, be made by others than the shippers themselves. The important thing however is that the plan be in place and be acceptable. Nothing should be shipped unless we are able to deal with its escape. If private industry cannot do it, then the government must supply the protection, something government at this time is quite unable to do. What government must do is examine the plan critically and keep it under constant surveillance.

The power to implement this recommendation seems clear from the Transportation of Dangerous Goods Act,

s. 21 giving the Governor in Council power to make regulations in s-s. (i) and (k) thereof as follows:

> "(i) prescribing circumstances in which the handling, offering for transport or transporting of dangerous goods is prohibited;"
>
> "(k) prescribing safety marks, safety requirements and safety standards of general or particular application;"

Section 17 of the Transportation of Dangerous Goods Act as pointed out (ante, p. 128) provides in effect that an inspector may "request" the shipper to put the plan into effect. Although s. 14(5) makes the failure to comply with a reasonable request an offence, I would have preferred the use of the more imperative word "require".

RECOMMENDATION FIVE

Transport Canada should make available through CANUTEC or otherwise the advice and direction needed upon a rail accident involving dangerous goods. In particular it should make available at the scene of, and within hours of, an accident, a person capable of directing the clean-up of that accident and of protecting the populace. He will lend all assistance to the local or provincial authorities and will take charge of the scene if no such authorities

are evident. This person, no doubt an inspector under the Transportation of Dangerous Goods Act, should report in writing after every accident to which he is summoned.

COMMENT

This, as I see it, is the major contribution by the Federal Government to the response to an accident, but it is no more than would be expected. The importance of the training of the federal representative at the scene cannot be overemphasized and there must be an adequate number of such representatives so distributed that any part of the country covered by rail will be able to obtain their assistance in person within a few hours. The 24-hour telephone number of CANUTEC should be in every police and fire station in the land and Transport Canada should prepare and provide to local emergency forces educational programmes in response to a dangerous goods spill.

RECOMMENDATION SIX

The railways should be required either by the CTC or by Transport Canada as appropriate to take action forthwith as follows:

(a) to publish for their crews guides for inspection by head end and tail end personnel of the train including the appropriate places for such inspection with particular reference to curves and stations in each division;

(b) to provide adequate paid instruction for their crews involved in the transportation of dangerous goods;

(c) to provide a formal training programme for carmen;

(d) to set forth rules for mechanical inspections;

(e) to set forth rules for record-keeping;

(f) to file with the CTC a list of their mechanical inspection points for approval;

(g) to publish to Transport Canada and any private or public response agencies their response plans which will include a 24-hour emergency telephone number where information as to the contents of trains may be obtained;

(h) to have available on all dangerous goods trains and at all division offices an accurate intelligible consist containing at least the car number and the name of

the dangerous commodity carried and to provide such consist to CANUTEC and to any municipal or provincial official forthwith on request, whether or not there has been an accident; the railways should also provide municipalities or communities having response personnel with information on the types of dangerous goods normally transported through them;

(i) to equip every caboose with speedometers, windshield wipers and window defrosters;

RECOMMENDATION SEVEN

The CTC should require the immediate trial by the railways of the following:

1. The installation of rear view mirrors on locomotives and their use in running inspections.
2. The installation of front and rear radio equipment capable of being received at some central point or points in the railway system and the maintenance of

a record of all communications between head and rear end. To this end the trial should impose upon the crew a standardized vocabulary.

COMMENT

As I have said, it is my belief that rear view mirrors would be of value in running inspections and that the record of communications would be of value both to the railways and the CTC in ensuring that all running inspections (and other operations) are properly conducted. I cannot be sure, however, until the experiment is undertaken and the results are assessed. If the assessment justifies the effort and expense (as I fully expect it will) the recommendation should become a regulation affecting all trains, or at least all trains transporting dangerous goods.

RECOMMENDATION EIGHT

The CTC should implement its intention expressed in the Glacier, B.C. report to impose upon the railways event recorders and operating standards for engineers and conductors.

RECOMMENDATION NINE

The CTC should require the railways to submit a table of the speed limits set by them for all trains on all routes as well as the criteria relied upon in the setting of them and information as to whether the trains may or may not be carrying dangerous goods. This information should be critically examined by the CTC and when the speed limits are found inappropriate the railways should be required to alter them.

COMMENT

The setting of speed limits for trains is no easy task. It depends on the nature of the train, of the track and of the topography. It is not intended by this recommendation to transfer the speed-setting process from the railways to the CTC. What is intended is that that process will come under scrutiny on behalf of the public. This recommendation is, of course, not intended to derogate from the specific regulation of speed set forth in Recommendation Three. It may also be that the control of the speed of dangerous goods trains will be taken over by Transport Canada—see Transport Canada's Management Plan (ante, p.177). As I said in dealing with that matter and it applies to many of the recommendations herein, critical examination of the information supplied is essential. Indeed

without it there is no point in getting the information at all.

RECOMMENDATION TEN

The CTC or Transport Canada should require shippers and carriers to replace all present dangerous goods placards with ones as nearly as possible impervious to fire and weather conditions.

RECOMMENDATION ELEVEN

Transport Canada should forthwith establish a permanent body to consider with research assistance -

(a) the adequacy of present safety devices in tank cars;

(b) the adequacy of all present government and AAR retrofit programmes;

(c) the relative merits of all hot box detectors including train-mounted devices and the appropriate interval on installation of any trackside detectors; in conjunction therewith the relative

merits of all dragging equipment detectors;

(d) the means of measurement of the amount of product remaining after a spill;

(e) the means of determining the risk posed by an escaping product;

(f) the most effective design of the cupola;

(g) the merits or demerits of the low, unloaded car immediately in front of the van;

(h) the colour-coding of dangerous goods tank cars;

(i) the raising of the numbers or other means of clear identification of the numbers of tank cars;

(j) the marshalling of a dangerous goods train;

(k) the re-routing of dangerous goods trains around urban areas.

COMMENT

I can only regret that I am here doing what I have complained of in others, i.e. making recommendations for further study. The matters listed are, however, real problems to which I do not have the answers. I can only hope that these answers will be forthcoming shortly and where the answers dictate affirmative action that such action will be taken immediately.

RECOMMENDATION TWELVE

Transport Canada or the CTC should be required to simplify the Red Book or the Dangerous Goods Code, whichever should be the current applicable dangerous goods regulation authority, so as to be intelligible to the general personnel of railways, manufacturers, producers and shippers.

COMMENT

It is to be hoped that this revision can be accomplished so as to produce an official document, but at the very least there should be a semi-official simplified version of the rules relating to the transport of dangerous goods by rail.

RECOMMENDATION THIRTEEN

The CTC should continue and expand its Monitoring of Train Operations Programme

COMMENT

The results of the programme to date (ante p. 123) have demonstrated to me that the supervision

of train repairs and train inspections cannot be left entirely to the railways. If the CTC is to take a more active position it may well require funding for additional personnel, but if the monitoring is followed by corrective measures by the railways and vigorous enforcement, including where necessary prosecution for breach, it will, in my opinion, be money well spent.

RECOMMENDATION FOURTEEN

The CTC should continue and expand its independent investigations of accidents and should report thereon regularly to the public.

COMMENT

The word "independent" is controlling here. I do not mean that the CTC should not continue to receive reports from the railways and in minor accidents perhaps accept those reports as final. In all major accidents, however, there should be a CTC authorized and controlled investigation followed by a public report. Again there may be need for additional financing.

It appears that the responsibility for

investigation of an accident involving dangerous goods may now fall upon Transport Canada under s. 20(1) of the new Act, although I understand that it is intended to use the CTC or the RTC officials for the purpose. The reports under the new Act are required to be published.

RECOMMENDATION FIFTEEN

Transport Canada should be required to publish annually or as they occur -

1. The reports of the inspector called to the scene of an accident under Recommendation Five.
2. The results of the investigations under Recommendation Eleven.

## EPILOGUE

The time has now come to thank all the people who helped so greatly throughout this Inquiry. They are:

- the investigators, Supt. Desmond Rowland, Det. Sgt. Edmund Kelly, Det. Sgt. James Bertram, Det. Boyd Brown and Det. Fred Lemieux, all of the Peel Regional Police Force who had begun their investigations long before this Inquiry was conceived and who continued to assist us throughout the Inquiry. I would be surprised if any fact escaped their detection.

- the railway experts, George Masters, Frank King and William Cant, who so patiently explained to us at the beginning just what a hot box was and which end was which of a tank car and indeed of a train, and as we became more educated took us on more and more trips into railway mystery.

- Zigi Vitols, our office manager, Kersi Chesson, our office assistant, Florence Gordon, our charming receptionist, and Arthur Savage, our hearing room usher, who were so helpful not only to us but to everyone who dealt with us.

- our secretaries, Dorothy Kosonic, Judy Darke, Carol Smith and Hope Brown, who so cheerfully handled the truly fearful amount of paper work involved in this Inquiry.

- the court reporters, Dorothy Marchant, Erma Thorburn, Pat Grainger, Barbara Maclauchlan and Rufus Dickinson who were so accurate and so industrious and who never seemed to mind the terrible hours we imposed upon them.

- my own secretary at Osgoode Hall, Lyn Archbold, who, while the hearing was on, typed up my illegible notes and after it was over masterminded me through the myriad drafts of this Report.

- the young lawyers, Richard Hay and Patricia Olasker, both already learned in the law, who helped us through most of the Inquiry but then left because of still further academic commitments.

- a still younger, not-quite-lawyer, Donald M. Cameron, who left us, after much assistance, for the Bar Admission Course but came back to make some very pointed critical comments on the Report.

- Thomas B. Millar, our executive director, who was rudely dragged from a well earned retirement as Deputy Local Registrar of the Supreme Court of Ontario, to run the whole administrative side. He not only was an excellent Registrar for the Inquiry but he must have done well as Administrator for I assisted him not at all and I have heard nothing but praise for his efforts.

- and finally the two gentlemen who, if this Inquiry has fulfilled its task, are most responsible: Robert P. Armstrong, Q of Toronto, Commission Counsel, and Willson A. McTavish, Q.C. of Mississauga, Associate Counsel. They were indefatigable in their pursuit of evidence and intelligent in its presentation. They were solicitous of the witnesses (the vast majority) who were endeavouring as best they could to tell their stories with truth in a strange environment; they were probing when the witness seemed reluctant or evasive or false. They were everything that counsel should be. I cannot say that they made my task easy. I can and do say that without them it would have been well-nigh impossible.

P.C. 1979-3286

APPENDIX 1

CANADA

PRIVY COUNCIL

Certified to be a true copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 4 December, 1979.

WHEREAS concern has been expressed

(a) about a derailment of a Canadian Pacific train that occurred in Mississauga, Ontario, November 10, 1979, involving the carriage of dangerous goods and the subsequent evacuation of the entire City of Mississauga; and

(b) in consequence, the level and adequacy of existing federal laws, regulations, rules and standards pertaining to safety and the enforcement thereof.

AND WHEREAS the Committee is of the opinion that it would be in the public interest and for the good government of Canada for the said concerns to be investigated.

Therefore, the Committee of the Privy Council, on the recommendation of the Minister of Transport, advise that Mr. Justice Samuel G.M. Grange, of Toronto, in the Province of Ontario, be appointed under Part I of the Inquiries Act and report upon the existing state of railway safety as it relates to the handling and carriage of dangerous goods with particular reference to:

1. the contributing factors and causes of the derailment at Mississauga, Ontario, on November 10, 1979 and the subsequent accident;

/2

2. the steps which can be reasonably taken to reduce the risk of recurrence of such an accident anywhere in Canada;

3. the level and adequacy of existing federal law, regulations, rules and standards and of the practices and procedures governing railway safety with respect to this accident and the prevention of future similar accidents involving the handling and carriage of dangerous goods by rail;

4. the adequacy of the existing practices, procedures and maintenance standards followed by the railways and the frequency of maintenance to ensure that the standards related to the handling and carriage of dangerous goods by rail are complied with;

5. the sufficiency of enforcement of existing railway safety legislation and standards related to the handling and carriage of dangerous goods by rail, including the training, qualification and number of federal inspectors;

6. how best investigative and corrective operations in response to an accident involving dangerous goods can be coordinated between various agencies, governmental and private, bearing in mind the existing jurisdictional and constitutional framework;

7. the distribution of functions concerning the safety, maintenance and inspection of railway roadbeds, tracks, equipment and signals;

8. any matters incidental or relating to any of the matters referred to in paragraphs 1 to 7;

The Committee of the Privy Council further advise

(i) that the Commissioner be authorized to adopt such procedures and methods as he may from time to time deem expedient for the proper conduct of the inquiry; including public hearings, and sit at such times and at such places in Canada as he may decide from time to time;

(ii) that the Commissioner be authorized to engage the services of such counsel, staff and technical advisers as he may require at rates of remuneration and reimbursement to be approved by the Treasury Board;

(iii) that the Commissioner be required to report to His Excellency the Governor in Council within six months on

(a) the safety of railway transport as it relates to the handling and carriage of dangerous goods;

(b) what steps can be taken to reduce the risk of recurrence of an accident such as occurred in Mississauga on November 10, 1979,

taking into account the matters referred to in paragraphs (1) to (8);

(iv) that the Commissioner be required, if requested by the Minister of Transport, by interim report to His Excellency the Governor General in Council, to report on any matter referred to in paragraphs (1) to (8) above, as well as the adequacy of the proposed Transportation of Dangerous Goods Act together with recommendations, if necessary, for the improvement thereof; and

(v) that the Commissioner be required to file with the Public Archives of Canada the papers and records of the Commission as soon as reasonably may be after the conclusion of the Inquiry.

CERTIFIED TO BE A TRUE COPY - COPIE CERTIFIÉE CONFOR

Marcel Massé

CLERK OF THE PRIVY COUNCIL - LE GREFFIER DU CONSEIL PRI

C.P. 1979-3286

CANADA

CONSEIL PRIVÉ

Copie certifiée conforme au procès-verbal d'une réunion du Comité du Conseil privé, approuvé par Son Excellence le Gouverneur général le 4 décembre 1979

Attendu que

(a) l'émotion soulevée par le déraillement d'un train du Candien Pacifique chargé de marchandises dangereuses à Mississauga (Ontario) le 10 novembre 1979 et l'évacuation complète de la ville; et

(b) les inquiétudes suscitées quant aux lois, règlementations et normes fédérales de sécurité en vigueur, ou à leur application.

Et attendu que le Comité estime de l'intérêt public et de saine administration qu'une enquête soit en conséquence instituée.

A ces causes, sur avis conforme du ministre des Transports, le Comité du Conseil privé conseille la nomination de Monsieur le Juge Samuel G.M. Grange de Toronto (Ontario), en vertu de la Partie I de la Loi sur les enquêtes, en vue de rendre compte des conditions actuelles de sécurité dans la manutention et le transport par rail de marchandises dangereuses et de rapporter plus précisement:

1. les causes et circonstances du déraillement survenu à Mississauga (Ontario) le 10 novembre 1979 ainsi que ses effets;

/2

2. les mesures que l'on peut raisonnablement envisager afin de prévenir, à l'avenir, la répétition de semblables accidents au Canada;

3. dans quelle mesure les lois, réglementations et normes fédérales en vigueur ainsi que les procédures et routines de travail observées dans ce cas, garantissent la sécurité de la manutention et du transport par rail des marchandises dangereuses;

4. dans quelle mesure les procédures et méthodes d'entretien aux chemins de fer et la fréquence des visites permettent d'assurer le respect des normes applicables à la manutention et au transport des marchandises dangereuses;

5. dans quelle mesure les moyens de faire appliquer les normes et règlements de sécurité relatifs à la manutention et au transport par rail de marchandises dangereuses sont suffisants, notamment en ce qui concerne la formation, la qualification et le nombre des inspecteurs fédéraux;

6. comment les enquêtes lancées et les mesures correctives introduites à la suite de tels accidents peuvent être coordonnées entre divers organismes officiels et privés, dans le cadre constitutionnel et juridictionnel existant;

7. les conditions de partage des responsabilités quant à la sécurité, l'entretien et l'inspection des plates-formes, voies, équipements et signaux;

8. toute observation pertinente ou se rapportant aux points 1 à 7 ci-dessus.

Le Comité du Conseil privé conseille en outre de donner mandat audit Commissaire

i) d'adopter telle procédure ou méthode jugée opportune, en son heure, à la bonne conduite de l'enquête, notamment la convocation d'audiences publiques où il siègera en temps et lieux choisis;

ii) d'engager les conseillers, personnels et experts techniques requis aux conditions pécuniaires approuvés par le conseil du Trésor;

iii) de présenter dans les six mois un rapport sur

a) la sécurité de la manutention et du transport par rail des articles dangereux;

b) les mesures destinées à prévenir toute répétition de l'accident survenu à Mississauga le 10 novembre 1979;

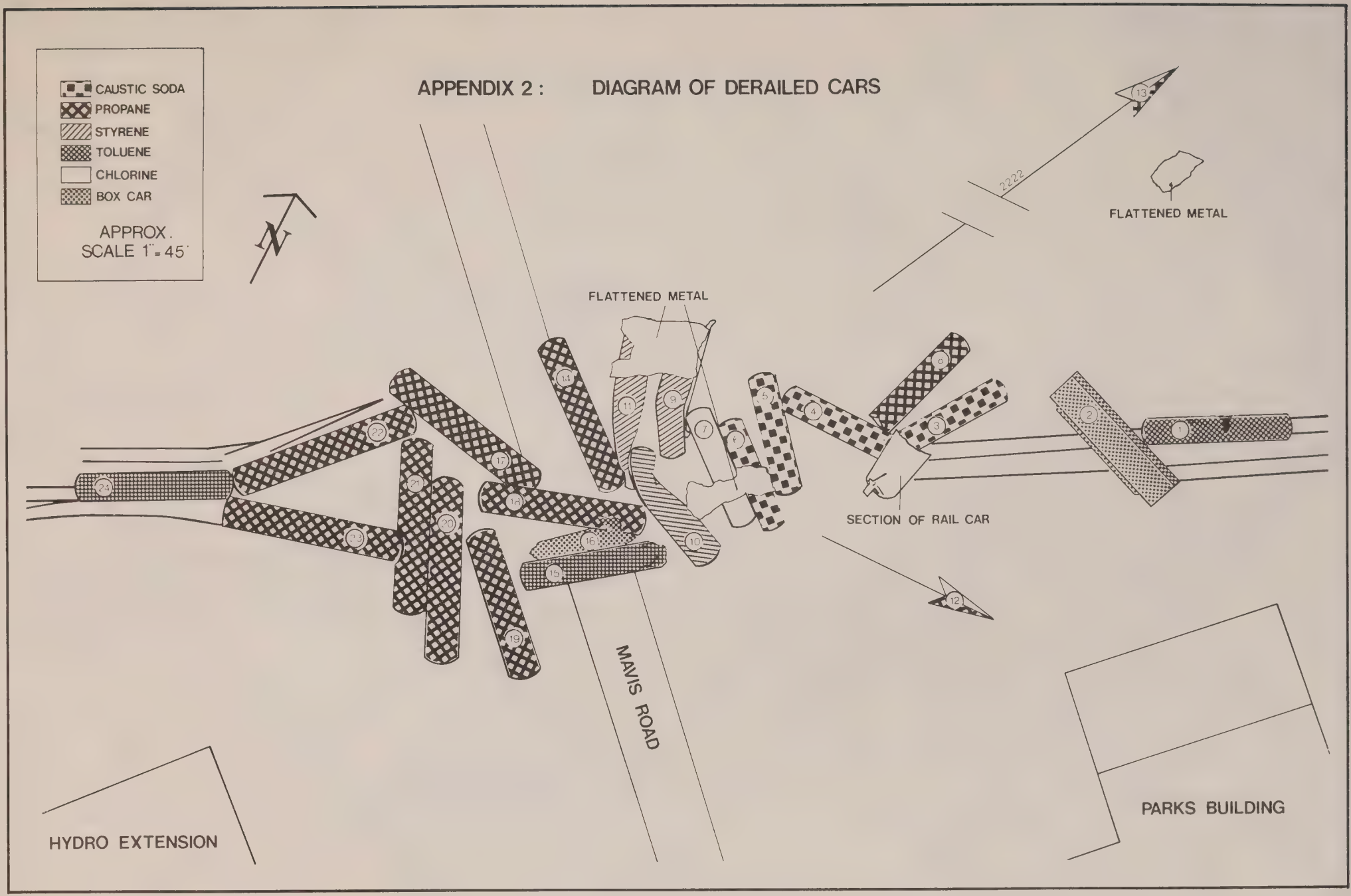
iv) de produire à la requête du ministre des Transports des rapports intérimaires sur toute question relative à ces points et au projet de loi sur le transport des articles dangereux et aux recommandations éventuelles en vue d'améliorer ce projet;

v) de déposer aux Archives publiques les textes et documents de la Commission dans un délai raisonnable après conclusion de l'enquête.

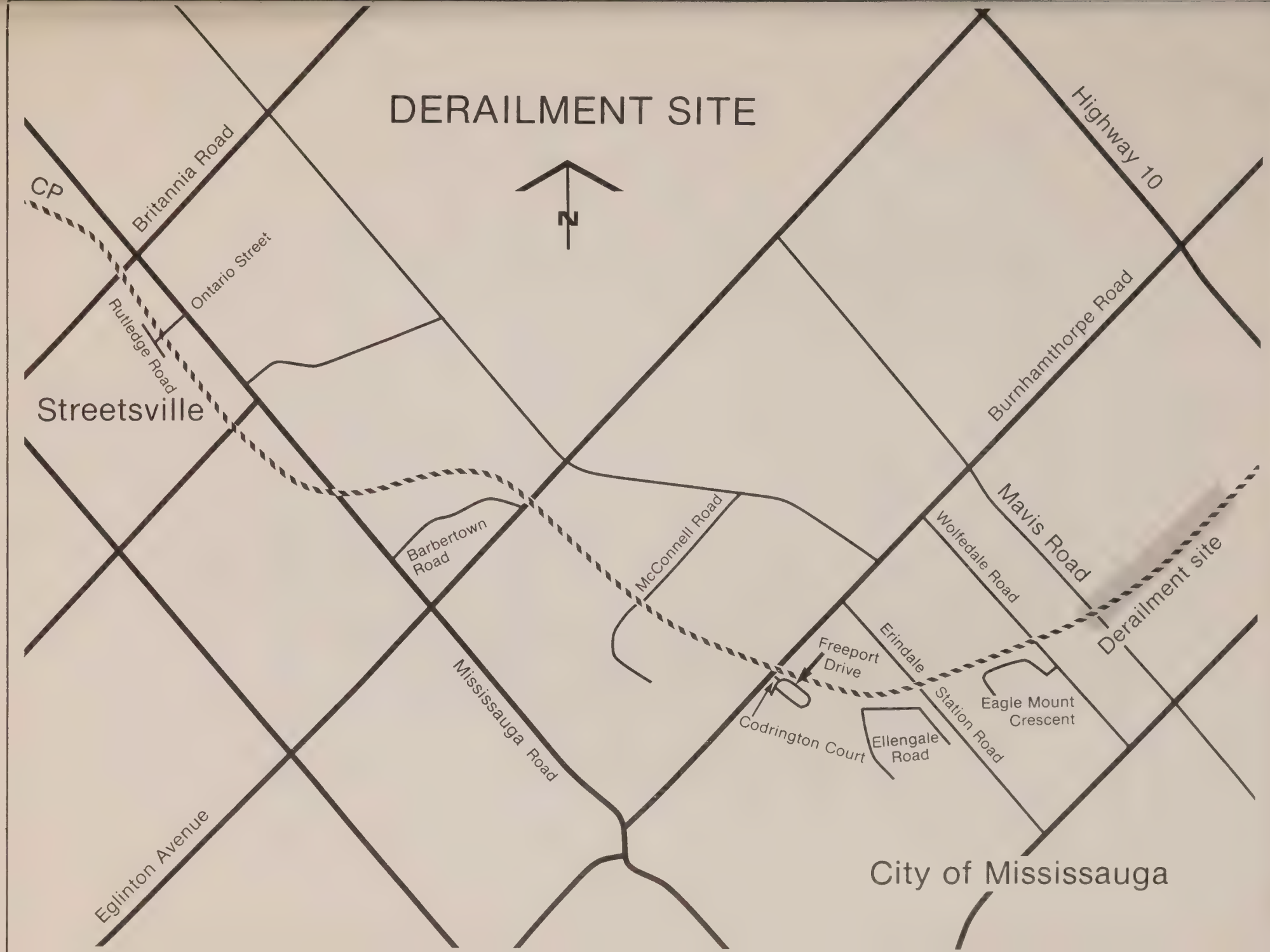
CERTIFIED TO BE A TRUE COPY - COPIE CERTIFIÉE CONFORME

Marcel Massé

CLERK OF THE PRIVY COUNCIL - LE GREFFIER DU CONSEIL PRIVÉ


CAUSTIC SODA
PROPANE
STYRENE
TOLUENE
CHLORINE
BOX CAR
APPROX.
SCALE 1"=45'
N
APPENDIX 2 : DIAGRAM OF DERAILED CARS
FLATTENED METAL
FLATTENED METAL
SECTION OF RAIL CAR
MAVIS ROAD
HYDRO EXTENSION
PARKS BUILDING


APPENDIX 3
GENERAL LOCATION
OF DERAILMENT SITE
N
CN
Georgetown
Winston Churchill Blvd.
Highway 10
Toronto
Etobicoke
Streetsville
Mavis Road
Derailment site
Mississauga Road
Erin Mills Parkway
Mississauga
CP
Derry Road
Trafalgar Road
County Road 9
Milton
Southdown Road
Highway 401
Campbellville
Guelph Junction
Burnhamthorpe Road
Queen Elizabeth Way
Oakville
CP
Puslinch
CN
CN
Lake Ontario


DERAILMENT SITE
N
CP
Britannia Road
Ontario Street
Rutledge Road
Streetsville
Highway 10
Burnhamthorpe Road
Mavis Road
Wolfedale Road
Barbertown Road
McConnell Road
Erindale
Station Road
Eagle Mount Crescent
Freeport Drive
Codrington Court
Ellengale Road
Derailment site
Mississauga Road
Eglinton Avenue
City of Mississauga

EX115 (retyped)

MEMORANDUM

TORONTO, December 3, 1979.

The following are excerpts of transcript of radio conversations taken from the Dictaphone 4000 tape recording unit housed in the Chief Train Dispatcher's Office - Toronto Union Station from 23:20 hours, November 10, 1979.

| | |
|---|---|
| 23.20.00 | Commence |
| 23.26.32 | "high ball 54" Engineman to Conductor (reply from head end to tail end train 54 leaving Guelph Jct). |
| 23.34.51 | "Guelph Jct. to the Terminal Dispatcher". (Operator Guelph Jct. to Toronto) |
| 23.35.14 | "Guelph Jct. to the Terminal Dispatcher". (Operator Guelph Jct. to Toronto) |
| 23.35.56 | "Guelph Jct. to the Terminal Dispatcher". (Operator Guelph Jct. to Toronto) |
| 23.36.33 | "Guelph Jct. to Terminal Dispatcher". (Operator Guelph Jct. to Toronto) |
| 23.36.35 | "High ball Milton 54" (Engineman to Conductor) |
| *23.56.50 | "Does 54 require a push" (Communication between Operator Guelph Jct. and Toronto Terminal Dispatcher.) |
| 23.37.05 | "Did you call a push engine Terminal Dispatcher". |
| 23.37.08 | (Unclear communication concerning 54) |
| 23.46.12 | "Tail end of 54" - Streetsville mile board" (Engineman to Conductor) "Roger" (Conductor to Engineman) |
| 23.47.19 | "High ball Streetsville 54" (Conductor to Engineman) |

* It was suggested in the evidence that this reference should have read "23.36.50".

23.47.22 "High ball Streetsville". (Engineman to Conductor)

23.53.53 "CP 54 to CP Terminal Dispatcher" (Engineman to Dispatcher)

23.54.06 "CP 54 to CP Terminal Dispatcher" (Engineman to Dispatcher)

23.54.27 "We're in the big hole Ted, but still moving". (Engineman #54 to Conductor #54)

23.54.47 "Jesus Christ Ted, one of them tank cars blew up. Tail end of 54. (Garbled) "CP 54 to CP Terminal Dispatcher." "CP 54 to CP Terminal Dispatcher." "CP 54 CP Terminal Dispatcher." "CP 54 CP Terminal Dispatcher." "CP 54 to Lambton - can anyone hear this radio. We've got a tank car that exploded on Cooksville hill. I'm getting the hell off of here". (Engineman to Conductor)

23.55.42 "What's that again." (Co-ordinator Toronto Yard to #54)

23.55.46 "Just by the - engines stopped at mileage 16.8" (Engineman #54)

23.55.52 "Will you keep quiet on the radio for a minute. Go ahead 2/54." (Co-ordinator Toronto Yard)

23.55.53 2/54, we've got a tank car on fire. It exploded on Cooksville hill." "Right OK get off." "We're getting off." (reference to 2/54 was an error by Engineman (excited))

23.56.19 "CP 54 to Terminal Dispatcher. "Terminal Dispatcher." "Tank car is derailed over the north side. I think by the lumber company." "Just by Dundas bridge there. The engine is stopped at the board on Cooksville. What is it 16.8 or 16.2." "Yeah thanks." "In that train (Coordinator) better get off there." "I think we better pull this head end." "You can see a light in the sky from here." (Co-Ordinator) "Yeah I know", I better call the fire department. (T.T.T. Dispatcher.)

23.57.52 "Hello Ted Nichol." "Guelph Jct." "54 to the tail end." "Yeah" "Where are you Ted." "Where abouts are you Ted." "I'm going to try and get the angle cock and pull the other cars down. It's a hell of a mess."

23.58.46 "How far are you from the tail end Larry?" (Engineman Pruss to head end Trainman Krupa)

23.59.02 "CP 54 to London Dispatcher." (Pruss to London Dispatcher)

23.59.05 "CP London Dispatcher Keith." (London Dispatcher to Engineman 54)

23.59.08 "You got that, did you Merv?" (Pruss to London)

23.59.10 "Yeah we heard a bit of it there, right - what is it - the Rocket Lumber Co. there at Cooksville (London Dispatcher Wallace to Pruss)

23.59.12 "Yeah, I think it is up on the hill, the top of the hill." (Pruss to London Dispatcher.)

23.59.16 "Yeah, the Toronto Chiefs trying to look after it from that end there, I'm just trying to get some information from you off the radio, just keeping an ear." (London to Engineman 54)

23.59.22 "Yeah we're going to go back and try to (garbled) tank cars down. I don't know how far from it." (Pruss to Wallace)

23.59.28 "You have quite a bunch of them on the head end. You don't know how far back it is by chance." (Wallace to Pruss)

23.59.31 "Larrys gone back - back about 10 about 30 cars. I believe (garbled)" (Pruss to Wallace.)

23.59.37 "Yeah OK what are you going to do, try to make a cut as close as you can to it, and pull them ahead eh?" (Wallace to Pruss)

23.59.47 "All right." (Wallace to Pruss)

23.59.50 "We're going to pull these cars down to the station." (Pruss to Wallace)

23.59.52 "You'd better get them away from you. There's quite a bunch there. OK, if you get to it, you give me the last one that you got with you there, if you can find out what that is, and we'll try to eliminate and see what it could be." (Wallace to Pruss)

November 11, 1979

00.00.03 "Yeah OK Merv." (Pruss to Wallace)

00.00.06 "Give me the number of the last 54, you've got chlorine on that train." "I sure wouldn't go anywhere near that." (Wallace to Pruss)

00.00.18 "How far do you figure the last car is from the fire Larry." (Pruss to Krupa)

00.00.26 "Oh well then we're alright. Get it when we pull down. We better pull down - let me know when you get it." (Pruss to Krupa)

Crew of 54-10

Conductor - E. Nichol
Engineman - K. Pruss
Head-End Trainman - . Krupa
London Train Dispatcher - M. Wallace
Co-Ordinator - C. Sims, Toronto

M.S. ANDREWS
Deputy Superintendent

APPENDIX 5

EX 360

# DERAILMENTS (ALL RAILWAYS) BY CAUSES

| YEAR | TRACK CONDITIONS | ROLLING STOCK | TRACK CARS | MISC. | TOTAL |
|---|---|---|---|---|---|
| 1973 | 121 | 107 | 15 | 71 | 314 |
| 1974 | 179 | 147 | 22 | 104 | 452 |
| 1975 | 144 | 115 | 14 | 99 | 372 |
| 1976 | 142 | 97 | 9 | 94 | 342 |
| 1977 | 128 | 128 | 10 | 67 | 333 |
| 1978 | 119 | 110 | 2 | 74 | 305 |
| 1979 | 134 | 132 | 16 | 86 | 368 |

. . SERVICES BRANCH
T.T.C. 80-06-03

APPENDIX 5

EX 361

# DERAILMENTS
## (ALL RAILWAYS)
## CAUSED BY EQUIPMENT

| YEAR | JOURNAL FAILURES | | | OTHER COMPONENTS * | TOTAL |
|---|---|---|---|---|---|
| | FRICTION | ROLLER | NOT IDENT. | | |
| 1973 | 28 | 6 | – | 73 | 107 |
| 1974 | 44 | 8 | 5 | 90 | 147 |
| 1975 | 36 | 9 | 3 | 63 | 115 |
| 1976 | 36 | 2 | 8 | 51 | 97 |
| 1977 | 39 | 9 | 1 | 79 | 128 |
| 1978 | 23 | 5 | 13 | 69 | 110 |
| 1979 | 41 | 18 | 2 | 71 | 132 |

* OTHER COMPONENTS INCLUDE WHEELS, AXLES, BRAKE GEAR, DRAFT GEAR AND SILLS.

CTC SERVICES BRANCH
C.T.C. 80-06-03

LIST OF BRIEFS FILED BY GROUPS OR PERSONS

Attorney General for Province of Ontario

Dr. James D. Bricker for a group of concerned citizens from Windsor

Brotherhood of Locomotive Engineers

Brotherhood of Maintenance of Way Employees

Brotherhood of Railroad Signalmen

Brotherhood of Railway Carmen of the United States and Canada

CN Rail

Canadian Association of Fire Chiefs

Canadian Association of Chiefs of Police

The Canadian Chemical Producer's Association

Canadian Environmental Law Association

Canadian General Transit Co. Ltd. and Hawker Siddeley (Canada) Ltd.

Canadian Railway Labour Association

Canadian Transport Commission

Professor E. Farkas

Basil Gerol

The City of Hamilton and the Regional Municipality of Hamilton Wentworth

Dr. G.L. Henderson for a group of concerned citizens from Windsor

Professor Julius Lukasiewicz

The Town of Markham

The City of Mississauga

The Municipality of Metropolitan Toronto

M-TRAC (Metro Toronto Residents' Action Committee)

The Town of Oakville

LIST OF BRIEFS FILED BY GROUPS OR PERSONS cont'd.

Ontario Association of Fire Chiefs

Frank Paul

Railway Transport Committee

Regional Transportation Safety Council - CN Rail - Great Lakes Division

North Rosedale Ratepayers Association - Toronto

The Toronto Section of the Chemical Institute of Canada

Transportation of Dangerous Goods Branch - Transport Canada

Alfred Tjernstrom (Malton Ratepayers' Association)

United Transportation Union
United Transportation Union, Local 344, Sarnia
United Transportation Union, Local 700, Ottawa
United Transportation Union, Local 1874, Winnipeg

Vancouver Island E & N Steering Committee

Dr. Gheorjhe Vasilca, G. Vasilca, P. Eng, and D. Vasilca, P. Eng.

The Town of Vaughan

The City of Windsor

Provincial Riding of York Centre

# LIST OF WITNESSES APPEARING BEFORE THE INQUIRY

| | |
|---|---|
| ABBOT, E.G. | Executive Secretary, Canadian Railway Labour Association |
| ALLEN, H.M. | C.N. Locomotive Engineer |
| ANTHONY, F. | Witness - Trafalgar Road |
| ANTLE, N.L. | Director, Rules & Inspection, Mechanical Div. of the Association of American Railroads |
| BABCOCK, J. | Chesapeake & Ohio Railway Brakeman |
| BACH, G. | C.P. Conductor on Train #84 |
| BAILLIE, K. | C.P. Operator at Woodstock |
| BATHGATE, G. | C.P. Road Foreman / Trainmaster at London |
| BEGG, J.S. | Chesapeake & Ohio Railway Terminal Trainmaster |
| BEHREND, H. | Co-chairman - M-TRAC |
| BERTRAM, J. | Detective Sergeant, Peel Regional Police Force |
| BILLINGSLEY, R. | C.P. Engineer - Met Train #54 at Nissouri |
| BOTA, N. | Witness - Streetsville |
| BRICKER, Dr. J.D. | Re Powell Siding, Windsor |
| BROUWER, J. | Captain - Mississauga Fire Dept. |
| BROWN, A.B. | Detective - Peel Regional Police Force |
| CANIFF, W.L. | Technical Director, TEAP |
| CAREW, C.W. | Representative of United Transportation Union, Local 344 |
| CAREY, Dr. J. | Witness - Burnhamthorpe & Erindale Station Road. |
| CARTER, C.A. | Witness - Barbertown Rd. north west of Eglinton |

LIST OF WITNESSES cont'd.

| | |
|---|---|
| CHANDLER, W. | Witness - Erindale Station Road. |
| CHRISTIAN, K. | C.P. Train Dispatcher - London |
| COOK, C. | C.P. Rear End Trainman on Train #84 |
| CORREA, G. | Witness - near Erindale Station Road. |
| CROSBIE, D.T. | Chairman, Traffic Committee, Canadian Association of Chiefs of Police |
| CULLEN, Dr. A. | Associate Professor of Optometry at University of Waterloo |
| DABOR, R.W. (Mr. & Mrs.) | Witnesses at Mavis Road intersection |
| DAGELMAN, G. | C.P. Trainman - Met Train #54 at Nissouri |
| DAVIES, E.J. | Vice-President and Canadian Director and Chairman of National Legislation Board of Brotherhood of Locomotive Engineers |
| DEADMAN, R. | C.P. Brakeman/Yardman - observed Train #54 at Jellicoe |
| DECKERT, A. | Inspector - Bureau of Explosives |
| DIONNE, N. | C.P. Trainman - Met Train #54 at Guelph Junction |
| DOUGLAS, P. | Shell Shipping Clerk |
| DOWNEY, V. | Representative of Canadian National Locomotive Engineers |
| DRAIMIN, B. (Mrs.) | Represented Moore Park Ratepayers - M-TRAC |
| DRONICK, M. | C.P. Operator at Guelph Junction |
| DUKE, J.A. | Witness at Wolfedale Road |
| ELLISON, T.D. | Director of Transportation of Dangerous Goods Branch - Federal Government, Ottawa |

LIST OF WITNESSES cont'd.

| | |
|---|---|
| ENGLISH, G. | Canadian Institute of Guided Ground Transport - Queen's University |
| FAULKNER, D.C. | C. & O. Engineer |
| FISHER, C.E. | Dome (Sarnia) Tank Car Loader |
| FISHER, I. | Re Powell Siding, Windsor |
| FICHTER, F. | C. & O. Labourer, Sarnia |
| FOSTER, B.W. | C.P. Trainman - Met Train #54 at Puslinch |
| FLETCHER, J. | C.P. Trainman - Met Train #54 at Guelph Junction |
| GALVAN, A. | Witness - near Burnhamthorpe Road |
| GIRARD, R. | Re Powell Siding, Windsor |
| GODFREY, P. | Metro Toronto Chairman |
| GOWDEY, G. | Mechanical Dept. Foreman - C. & O. Sarnia |
| GRAY, J.,Q.C. | Chairman, Rail Transport Committee, C.T.C. |
| GREENWOOD, S.T. | Supervisor, Production Services Dept. - Dow Chemical |
| HAGGITH, J. | C.P. Trainman - Met Train #54 at Nissouri |
| HALL, G. | Shell Supervisor, Rail Equipment |
| HAMLIN, F. | Production Manager, Chloralkali Products, Dow Chemical |
| HARWOOD, P.J.R. | Witness at Wolfedale Road |
| HAYES, C. | Representative of Scarborough Ratepayers' Assoc. - M-TRAC |
| HENDERSON, Dr. G.L. | Re Powell Siding, Windsor |
| HENDERSON, P.J. | C. & O. Operator Clerk |
| HENNESSY, J. | President, Hennessy Products Corporation |

LIST OF WITNESSES con'td.

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|---|---|
| HICKS, D. | Dome Tank Car Loading Trainee |
| HILL, L.A. | C.P. General Manager |
| HLADY, G. | System General Chairman, Brotherhood of Railway and Airline Clerks |
| HOGAN, K. | Shell Refinery Superintendent |
| HOLLOWAY, C.E. | Professor, York University |
| HOPPER, K.J. | C.P. Carman in London |
| HOPE, Ying | Alderman, Ward IV, Toronto |
| HINKLEY, B. | Alderman and Chairman of Railway Safety Committee - City of Hamilton |
| HOUSTON, A.J. (Mr. & Mrs.) | Witnesses at Campbellville |
| HUNT, S. | Representative - M-TRAC |
| HUTCHINSON, C. | Witness at Burnhamthorpe Road |
| HYDE, T.H. | Witness at Wolfedale Road |
| JAMIESON, A. | C. & O. Yard Foreman |
| JOHNSON, D. | Divisional Manager - Superior Propane Ltd. |
| JOHNSON, R.W. | Marine Operations Manager - Eastern Canada - Dow Chemical |
| JONES, A. | C.P. Carman at Chatham |
| JONES, D.H., Q.C. | Commissioner, C.T.C. |
| KARASKEWICH, W.F. | Manager - Dangerous Commodities Assessment, Railway Transport Committee, C.T.C. |
| KELLY, B. | Constable - Peel Regional Police |
| KELLY, R. | Mississauga District Fire Chief |
| KELSALL, J.P. | C.P. Superintendent in Sudbury Division |
| KEYES, G. | C. & O. Sarnia Carman |

LIST OF WITNESSES cont'd.

| | |
|---|---|
| KING, A.W. | Queen's University, Kingston |
| KING, B.V. | Inspector - Peel Regional Police |
| KINGSWOOD, R. | C. & O. Trainman/Yardman |
| KRUPA, L. | C.P. Trainman on Train #54 |
| KUNZ, E.L. | Engineering Consultant |
| LASSONDE, F. | Manager, Mechanical Operations, North American Car |
| LEE, Dr. J. | Professor of Mechanical Engineering - McGill University |
| LEMON, E. | C.P. Engineer - Met #54 at Puslinch |
| LEPAGE, G. | Supervisor, Air Brakes and Director of Dangerous Commodities - C.P. Rail |
| LEROY, M. | C.P. Assistant Signal Supervisor |
| LUCAS, D.M. MSc | Director - Centre of Forensic Sciences, Ministry of Solicitor General, Ontario |
| LUKASIEWICZ, J. | Professor, Carleton University |
| LYDEN, M.E. | Senior Staff Engineer, Chlorine Institute |
| MAHONEY, W. | C.P. Front End Trainman on Train #84 |
| MALCOLM, S. | Constable - Peel Regional Police |
| MANN, A.E. | C.P. Conductor - Met #54 at Guelph Junction |
| MARCHETTI, A. | Alderman, Borough of Etobicoke |
| MASTERS, G. | Research Consultant, M.R.A.I. |
| McCONNELL, E.C. | Constable - Peel Regional Police |
| McDONALD, J. | C. & O. Trainman |
| McDONNELL, G. | C.P. Operator at Galt |
| McDUFFE, D.V. | Representative of the United Transportation Union |

LIST OF WITNESSES cont'd.

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|---|---|
| McGREGOR, D. (Mr. & Mrs.) | Witnesses at Derry Road |
| McLEOD, J.H. | Acting General Chairman - Canadian Pacific Lines West |
| McLEOD, R. | C.P. Trainman on train that met #54 at Puslinch |
| McLUSKEY, P.N.C. | Representative - M-TRAC |
| McRAE, G. | Shell Dispatching Shift Foreman |
| MILLAR, C. | Reporter/Photographer with Toronto Sun |
| MITCHELL, R.L., Jr. | Executive Director, Chlorine Institute |
| MOORE, L. | C.P. Engineer - Met #54 at Guelph Junction |
| MOYAR, G. | Consultant for Chesapeake & Ohio Railway |
| MYERS, R.H.H. | M.P.H.A. Topographics Ltd. (Constructed model of train wreck) |
| NETHERCOTT, R. | C. & O. Carman |
| NICHOL, W.E. | C.P. Conductor on Train #54 |
| NUTKINS, G.A. | C.P. Superintendent, London Division |
| O'BRIEN, R.T. | Vice President - United Transportation Union |
| OXENHAM, S. (Mrs.) | President - A.B.C. Residents' Association |
| PAIGE, S. | Witness at Erindale Station Road |
| PARET, A. | Sergeant - Peel Regional Police |
| PAROIAN, L. | Re Powell Siding, Windsor |
| PARSONS, C. | C.P. Conductor - Met #54 at Nissouri |
| PAUL, F. | Re CN bridge, Etobicoke |
| PELLARIN, D. | Re Powell Siding, Windsor |

LIST OF WITNESSES cont'd.

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|---|---|
| PICCOLO, M. | C.P. Carman in London |
| PLATT, J. | Vice President - Brotherood of Railroad Signalmen |
| PRUSS, K. | C.P. Engineer on Train #54 |
| RAYMOND, J.P. | General Vice President, Administrator-Brotherhood of Railway Carmen |
| RICHMOND, T. | Sergeant - Peel Regional Police |
| RIDDELL, J. (Mr. & Mrs.) | Owners of property at 1437 Freeport Drive on which wheels landed |
| READY, T. | C.P. Engineer on Train #84 |
| REYNOLDS, J. | C. & O. Conductor Local 4 |
| REYNOLDS, L. | Shell Staff Engineer |
| RYAN, G. | Shell Loader (Loaded NCTX 22541) |
| ROBINSON, R.B. | Counsel for Metro Toronto |
| ROSS, C. | Witness at Wolfedale Road |
| SCOTT, D.A. | Vice-President, South Hill Home Owners' Association |
| SIU, H. | Witness at Eglinton Avenue |
| STRINGER, W. | Constable - Peel Regional Police |
| SMITH, R.G.W. | Representative of E. & N. Steering Committee |
| SMITH, R.W. | Professor - Metallurgical Engineering, Queen's University |
| SWINDELLS, R.W. | Captain - Mississauga Fire Dept. |
| TANDY, E. | Representative of Brotherhood of Railway Carmen |
| TEGGART, J. | Shell Fire and Safety Supervisor |
| TRUCKLE, T. (Mr. & Mrs.) | Witnesses -Burnhamthorpe Road |
| TYNDALL, B. | Dow Process Operator |

LIST OF WITNESSES cont'd.

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|---|---|
| TJERNSTROM, A.D. | Representative of Malton Ratepayers' Association |
| VASILCA, G. | Inventor |
| VIGOD, T. | Counsel, Canadian Environmental Law Association |
| WALLACE, M. | C.P. Train Dispatcher in London |
| WINTRINGHAM, H. | General Manager and Vice-President - Southland Mfg. Co., Norfolk, Va. |
| WOOD, B. | C.N. Dispatcher |
| WOOD, T.R. | Ontario Research Foundation |
| WRIGHT, E.H. | Retired Chief Mechanical Superintendent New York Central |
| WYROSTOK, R.Y. | General Chairman - Canadian Pacific Systems Federation |

## LIST OF COUNSEL AND REPRESENTATIVES WHO APPEARED BEFORE THE INQUIRY

| | |
|---|---|
| R.P. Armstrong, Q.C.<br>W.A. McTavish, Q.C.<br>Richard Hay<br>Patricia Olasker<br>D.M. Cameron | For the Commission |
| Blenus Wright, Q.C.<br>D.W. Burtnick<br>J. Zarudny<br>B. Fox<br>L. Lowla | For the Attorney General for Ontario |
| W.J.A. Hobson, Q.C.<br>Ann R. Johnstone<br>D. Olsen<br>B.R. Evernden<br>Walter Jancewicz | For Transport Canada |
| K.M. Bloodworth<br>J. Desjardins<br>D. Silverstone<br>S. Manion | For the Canadian Transport Commission |
| R.M. Robinson, Q.C.<br>A.M. Austin<br>W.T. McGrenere, Q.C.<br>L.W. Stewart, Q.C.<br>J. Lax<br>J. Menet | For the City of Mississauga and Metropolitan Toronto |
| J.G. Parkinson, Q.C.<br>J. Brian Casey<br>E.A. Cronk<br>H.M. McGillivray<br>P.Weiss<br>D.E. Milner<br>D. Garbig<br>I. Kyer<br>B. Salvatore<br>M. Merocchi | For the Region of Peel |
| M.E. Weir, Q.C.<br>S. Braithwaite<br>E. Trafford | For Hydro Mississauga |

LIST OF COUNSEL AND REPRESENTATIVES WHO APPEARED BEFORE THE INQUIRY cont'd.

| | |
|---|---|
| Gordon Bentley | Fire Chief of the City of Mississauga |
| Dennis Lane, Q.C.<br>W.M. Bryden, Q.C.<br>Brian Morgan<br>D. Hodgson<br>Mark Edwards<br>Linda Currie | For the Chesapeake & Ohio Railway Co. |
| G.D. Finlayson, Q.C.<br>John H. Francis, Q.C.<br>Brian J.E. Brock<br>Glenn A. Smith<br>D.L. Weldon<br>M. Weizman | For Dow Chemical Canada Limited |
| J.P. Bassel, Q.C.<br>T.B.O. McKeag, Q.C.<br>J. Murray Davison<br>B.I. MacTaggart<br>Stanley Tick<br>R.M. Zarnett<br>J. Temple<br>R.B. Thibodeau<br>Robert Lee<br>G. Ludlow<br>I. Wismer<br>B. Irwin<br>L. Vandor | For Shell Canada Limited |
| J.W. O'Brien, Q.C.<br>W. Pepall<br>C. Diamond<br>Michael O'Brien<br>D. McGhee<br>A. Conant<br>W. Kumbert<br>P. Rekai<br>B. Waldron | For North American Car Limited |
| R.E. Shibley, Q.C.<br>W.L.N. Sommerville, Q.C.<br>N.A. Chalmers, Q.C.<br>J.L. Bowles, Q.C.<br>D.A.L. Britnell, Q.C. | For Canadian Pacific Limited |

LIST OF COUNSEL AND REPRESENTATIVES WHO APPEARED BEFORE THE INQUIRY cont'd.

| | |
|---|---|
| R.M. McLean<br>B. McGarva<br>J.P. Malette<br>G. Sparrow<br>V. Kololian<br>S.F. Waque | |
| H.G.J. Pye, Q.C.<br>M. Beaulieu<br>T.E. Dolphin<br>M.E. Hancock<br>R.W. Bowman<br>L.I. Brisbin<br>R.L. Boileau<br>Serge Cantin<br>W.D. Connon<br>George P. Bouchey<br>J. Stratton<br>Francis S. Hutton | For the Canadian National Railway Company |
| John Cannings<br>J. MacDonald<br>F. Fyles<br>L. Endross<br>M.S. Panicali<br>Donald G.M. Brown | For C.G.T.X. and Hawker Siddeley (Canada) Ltd. |
| John D. Richard, Q.C.<br>R. Dearden<br>R. Nelson<br>M. Young | For the Canadian Chemical Producers Association and Wilburt Caniff |
| D.V. McDuffe<br>Leo Breen<br>M. Marcolini | For the United Transportation Union |
| E.G. Abbot | For the Canadian Railway Labour Association |
| Grace Patterson | For the Canadian Environmental Law Association |
| L.H. Mandel, Q.C.<br>Frederick Sagel<br>A. Brands<br>J. Bradley<br>D. Dunnet<br>James Norton<br>A. Farrar | For 350 businesses and individuals in Mississauga |

LIST OF COUNSEL AND REPRESENTATIVES WHO APPEARED BEFORE THE INQUIRY cont'd.

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|---|---|
| Anthony H. Speciale<br>P. Friedlan | For 70 businesses and individuals in Mississauga |
| Samuel H. Moerman | For Robert L. Mitchell, Jr. and Michael E. Lyden of the Chlorine Institute |
| Charles F. McKeon, Q.C. | For David Johnson of Superior Propane Ltd. |